REMARKS

The Present Invention and Pending Claims

Claims 1, 4-11, and 14-26 are pending and directed to a base fabric for a hollow-woven air bag (claims 1, 4-10, 23, and 24), an air bag comprising the base fabric (claims 11, 14-20, 25, and 26), and a side impact protection air bag (claims 21 and 22). By inserting a special structure band into the boundary portion between the bag portion and the single layer that is interwoven by a yarn A, any deviation in the boundary portion is reduced when the air bag is expanded, the leaking of gas generated from the inflator is generally prevented with good reliability, and the internal pressure holding performance of the air bag is improved. The present invention, therefore, provides a base fabric for a hollow-woven air bag that is capable of solving the problem of air leaking from the boundary portion between the bag portion and the single layer that is interwoven by a yarn.

Amendments to the Claims

The claims have been amended to point out more particularly and claim more distinctly the present invention. The claims also have been amended to clarify grammar. Specifically, the claims have been amended to replace "fastened portion" with "a single layer that is interwoven by a yarn," which is supported by the specification at, for example, page 2, lines 19-20. The claims also have been amended to remove the terms in parentheses. Additionally, claim 1 has been amended to incorporate the features of claim 3. Claim 4 has been amended place the claim in independent form, to incorporate the features of claim 3, and to recite "warps and/or wefts of at least two lines" as supported by the specification at page 28, lines 15-19. Claim 5 has been amended to place the claim in independent form and to incorporate features of claim 3. Claim 11 has been amended to incorporate the features of claim 13. Claim 14 has been amended to place the claim in independent form, to incorporate the features of claim 13, and to recite "warps and/or wefts of at least two lines" as supported by the specification at page 28, lines 15-19. Claim 15 has been amended to place the claim in independent form and to incorporate the features of claim 11. Claims 23 and 24 are new and recite the features previously recited in claim 2. Claims 25 and 26 are new and recite the features previously recited in claim 12. Claims 2, 3, 12, and 13 have been canceled to prevent redundancy. No new matter has been added by way of these amendments.

The Office Action

The Office objects to the specification. Additionally, claims 1-22 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite. The Office also rejects claims 1-22 under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. Patent No. 6,220,309 (Sollars). Reconsideration is hereby requested.

The Objection to the Specification

The Office objects to the specification, but does not indicate reasons for the objection. Accordingly, Applicants request additional information, such that Applicants can address the specific concerns of the Office.

Discussion of the Rejection under Section 112, second paragraph

The Office contends that the claims are indefinite because they encompass informalities. The claims have been amended to replace "fastened portion" with "a single layer that is interwoven by a yarn." The term "boundary face" refers to the "boundary face with the bag portion." The term "interlaced" signifies "woven," as is apparent from the specification.

Regarding claim 7, the Office requires clarification regarding the rate of variation of thickness. The variation in the thickness denotes a variation in thickness of the entire "base fabric" of the present invention, and is not directly related to the "cover factor (CF)." As indicated by the accompanying drawing (see Attachment A), it is preferable that the rate of thickness variation of the "air bag portion" is as small as possible so as to reduce the number of creases in rolled form (which can adversely affect handling).

The Office also contends that the crimp factor cannot be determined if the width is unknown. Measuring the "crimp ratio" has been performed by the method described in the specification at page 22, lines 1-14. Additionally, the method is described in detail in Japanese Industrial Standard (JIS) L 1096 (1990) (see Attachment B, which is enclosed herewith).

For the above reasons, Applicants believe the pending claims, as amended, to be definite, and the rejection should be withdrawn.

Discussion of the Rejection under Section 102(b)

The Office contends that the '309 patent discloses all of the elements of the pending claims and, therefore, anticipates the present invention. Applicants traverse this rejection for the following reasons.

The '309 patent relates to an inflatable fabric comprising basket-woven attachment points between fabric panels. The '309 patent discloses the use of an inflatable fabric in an air bag cushion; however, the '309 patent does not disclose the use of a special structure band in the boundary portion between the bag portion and the single layer that is interwoven by a yarn A, as required by the pending claims.

As is apparent from the "weave diagram 30" illustrated in Fig. 2 of the '309 patent, there is no different piece of fabric inserted into the boundary portions at which the "double fabric layers 32" (two-layer plain-wave-signifying block) and the "up-down basket weave pattern 34" adjoin each other, as in the present invention. Accordingly, the '309 patent does not disclose all of the elements of the pending claims and cannot be considered to anticipate the present invention.

Moreover, the '309 patent does not suggest modifying the inflatable fabric disclosed therein in the manner necessary to yield the present invention. Indeed, the "weave diagram 30" of the '309 patent corresponds to the pattern illustrated in the comparative examples of the specification of the present application. As described in the specification of the present application, the claimed base fabric and air bag comprising the base fabric are superior to those described in the comparative examples of the specification in terms of the opening at the margin, air permeability, and the quality of the air bag. Thus, the inflatable fabric of the '309 patent and the air bag comprising the inflatable fabric are inferior to the fabric and air bag of the present invention. Under the circumstances, the present invention also cannot be considered to be obvious in view of the '309 patent.

Additionally, the claims as amended describe a base fabric and air bag that differs from the disclosures of the other references cited by the Office (e.g., U.S. Patents 5,865,464, 6,595,244, and 6,488,311). For example, the '311 patent discloses an integrally woven air bag with hollow portions (A to K), a boundary portion (L), and single-cloth portions (L, a, b), as depicted in Figs. 1 and 2 thereof. While this structure bears some resemblance to the structure depicted in Fig. 5 of the present application (see Example 2, which relates thereto), the present invention, as defined by the pending claims as amended, differs from the disclosed structure of the '311 patent. None of the cited references discloses a base fabric or air bag comprising the base fabric, wherein the base fabric comprises the combination of features recited in the pending claims. Moreover, none of the cited references, alone or in combination, teach or suggest altering the disclosures of the references to arrive at the base fabric and air bag comprising the base fabric of the present invention. Accordingly, the '309 patent and the other cited references, whether considered alone or in combination, cannot

properly be considered to anticipate or render obvious the present invention as defined by the pending claims.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

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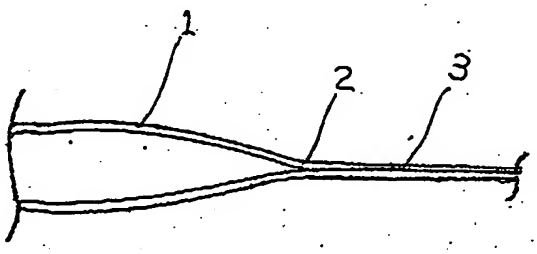
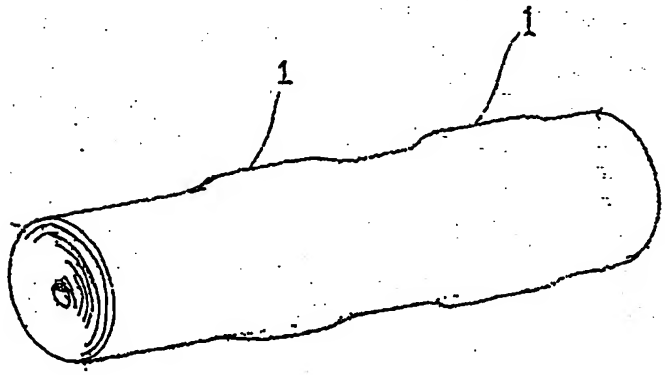
Date: October 30, 2003

Amendment or ROA - Regular (Revised 7/29/03)

a section view of FIG. 1



a role of base fabric for hollow-woven air bag



UDC 677.064:677.01

JIS

This English version is for information purpose only.
The original Japanese text of this Standard was revised in Apr., 1999

JAPANESE INDUSTRIAL STANDARD

Testing Methods for Woven Fabrics

JIS L 1096–1990

Translated and Published

by

Japanese Standards Association

Printed in Japan

46 S

In the event of any doubt arising,
the original Standard in Japanese is to be final authority

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association.

Errata will be provided upon request, please contact:
usiness Department,
Japanese Standards Association
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462

Errata are also provided to subscribers of JIS (English edition) in *Monthly Information*.

Contents

UDC 677.064:677.01

JAPANESE INDUSTRIAL STANDARD J I S

Testing Methods for Woven Fabrics L 1096-1990

1. Scope

This Japanese Industrial Standard specifies the testing methods for the evaluation of general characteristics of woven fabric foundation cloth (1).

Note (1) Test methods for hosiery fabrics, carpets and rugs, urethane clothing, flocked clothing, and bonded clothing for garment shall be as specified in the appropriate Standards.

Remark: The units and numerical values given in { } in this Standard are based on the traditional units and are currently the criteria in force.

2. Definition

The definitions of the terms used in this Standard shall be as follows:

(1) standard condition of test room or apparatus The condition of the test room or the test apparatus within the tolerance range of 20 ± 2°C and 65 ± 2 % with respect to temperature and humidity as specified in JIS Z 8703.

(2) standard condition of sample The state of a sample having reached moisture equilibrium after left in the test room under the standard condition.

(3) moisture equilibrium The state of a sample having reached a constant mass or a constant length after left in the test room under the standard condition subsequent to preliminary drying making moisture regain lower than official regain (temperature 40 ± 5°C).

Remark: Fabrics 0 % in official regain may dispense with preheating.

(4) absolute dry condition of sample The state of a sample having attained a constant mass after kept in a drier kept at a temperature of 105 ± 2°C.

Remark: For fabrics 0 % in official regain, its standard condition shall be regarded as the absolute dry condition.

(5) absolute dry mass The mass of a sample attained when it has been kept under the absolute dry condition.

(6) Constant mass When the mass of a sample is measur d at an interval of 1 h or longer in a moisture equilibrium and at an interval of 15 min or longer in an absolute dry mass state, the state in which the differenc b tween the two mass values succ ssively weighed comes to within 0.1 % of the latter mass valu .

Applicable Standards, Corresponding Int rnational Standards and Reference

(7) constant legnth When the l ngth between gauge marks of the sample (200 mm) is m asured at an interval of 1 h r longer, the state in which the difference betwe n th two length values successively measured comes to within 0.5 % of the latter l ngth.

(8) official regain Official value of regain, which is th percentage of the difference b tween the mass of a t xtile material measur d at an arbitrary temperature and its absolute dry mass relative to the absolute dry mass.

(9) corrected mass A mass obtained by adding a mass equivalent to official regain to an absolute dry mass.

(10) yarn number count and fineness A unit expressing thread thickness. The yarn number counts and finenesses used in this Standard shall be as follows:

(a) cotton yarn number A yarn number count which expresses a thread length per 453.59 g in corrected mass by the number of hanks (one hank is 768.1 m).

(b) metric count A yarn number count which expresses a thread length per 1 g in corrected mass by the number of meters.

(c) flax yarn number A yarn number count which expresses a thread length per 453.59 g in corrected mass by the number of leas (one lea is 274.32 m).

(d) jute yarn number A yarn number count which expresses a thread corrected mass per 29.029 km in length by the number of kilograms.

(e) denier (D) A thread corrected mass per 9 km in length expressed by the number of grams.

(f) Tex (tex) A thread corrected mass per 1 km in length expressed by the number of grams.

(11) initial testing force A load applied in the first stage to an extent that it will not elongate the test piece but will eliminate unnatural wrinkles.

3. Sampling and Preparation of Specimen

A sample shall be large enough to take a specimen therefrom. The specimen shall, as a rule, be taken from a part 100 cm or over apart from the end of fabrics, and from a part 10 cm or over apart from each selvage, if any, to be kept under the standard condition. However, when this provision is not applicable, the specimen shall be taken from a part representive of the fabrics to be kept under the standard condition.

Further, when the sample is a product, the specimen shall be taken at random to be rendered into the standard condition.

Furthermore, to a test not affected by temperature and humidity, this provision does not apply.

4. Test C nditions

4.1 Testing Site A test site shall be a test room kept under the standard conditions. If a test room cannot keep the standard condition, the place as close to the standard condition as possible shall be selected and, in this case, the temperature and humidity at the time of the test shall be noted in the report. However, the test which temperature and humidity do not affect shall be exempted from the application of the above rule.

4.2 Absolute Dry Mass In order to obtain an absolute dry mass, it is permitted to use an infrared drier, pressure reducing drier, etc. in place of a hot air drier. In this case, the drier used shall be noted in the test report.

For a fabric composed of fiber to be influenced by temperature, a temperature below 105°C shall be used, and the temperature used shall be noted in the test report.

4.3 Official Regain The official regain of a fabric made of a kind of fiber shall be as given in Table 1. The official regain of a fabric of fiber mixture shall be calculated from the formulas below by the use of official regain of Table 1 given for each individual fiber composing the fabric.

(1) When obtaining from mixture ratio based on absolute dry mass,

$$R = \frac{AR_1 + BR_2 + \cdots + NR_n}{100}$$

where, R: calculated official regain (%) of fabric of fiber mixture

$A, B, \cdots, N$: mixture ratio (%) based on absolute dry mass of each individual fiber

$R_1, R_2, \cdots, R_n$: official regain (%) of individual fiber.

(2) When obtaining from mixture ratio based on corrected mass,

$$R = \frac{\dfrac{aR_1}{1+\dfrac{R_1}{100}} + \dfrac{bR_2}{1+\dfrac{R_2}{100}} + \cdots + \dfrac{nR_n}{1+\dfrac{R_n}{100}}}{\dfrac{a}{1+\dfrac{R_1}{100}} + \dfrac{b}{1+\dfrac{R_2}{100}} + \cdots + \dfrac{n}{1+\dfrac{R_n}{100}}}$$

where, R: calculated official regain (%) of fabric of fiber mixture

$a, b, \cdots, n$: mixture ratio (%) based on corrected mass of individual fiber

$R_1, R_2, \cdots, R_n$: official regain (%) of each individual fiber.

Remark: Expansion of the formula given in (2) above will be the following:

$$\frac{100}{100+R} = \frac{a}{100+R_1} + \frac{b}{100+R_2} + \cdots + \frac{n}{100+R_n}$$

or

$$R = \left(\frac{1}{\frac{a}{100+R_1} + \frac{b}{100+R_2} + \cdots + \frac{n}{100+R_n}} - 1 \right) \times 100 .$$

Table 1. Official Regain of Each Fiber

Nature of fiber	Official regain (%)	Nature of fiber	Official regain (%)
Cotton	8.5	Vinylon	5.0
Wool	15.0 ([2])	Vinylidene	0
Silk	12.0 ([3])	Polyvinylchloride	0
Flax and ramie	12.0	Polyester	0.4
Jute	13.75	Acryl and acryl type	2.0
Rayon	11.0	Polyethylne	0
Polynosic	11.0	Polypropyrene	0
Cupra	11.0	Polyurethane	1.0
Acetate	6.5	Polyclar	3.0
Triacetate	3.5	Benzoate	0.4
Promix	5.0	Glass fiber	0
Nylon	4.5	Aramid	7.0

Notes ([2]) This regain to be effected under the standard condition shall be used, unless otherwise specified.

([3]) This regain applies to the degummed silk.

4.4 Temperature and Humidity Humidity shall be obtained by using Meteorological Agency type or Assmann's type aspiration psychrometer specified in JIS Z 8806, and relative humidity shall be obtained from the humidity table based on Sprung's formula.

5. Test Items

The test items for this Standard shall be as enum rated below.

(1) Weave

(2) Width

(3) Length

(4) Mass per unit area

(5) Thickness

(6) Density

(7) Crimp percentage of yarn

(8) Structure of yarn used

(9) Moisture regain

(10) Apparent specific gravity and pore volume

(11) Bowing

(12) Tensile strength and elongation percentage

(13) Elongation elastic modulus

(14) Stretchability of stretch fabrics

(15) Tearing strength

(16) Bursting strength

(17) Abrasion resistance

(18) Compressibility and compression elastic modulus

(19) Stiffness

(20) Bending repulsion

(21) Slippage resistance

(22) Wrinkle recovery

(23) Wrinkles after laundering

(24) Pleat retention

(25) Drying property

(26) Water absorbing property

(27) Air perm ability

(28) Warmth keeping property

(29) Light resistance

(30) Weather resistance

(31) Mothproofness

(32) Discoloration due to abrasion

(33) Size content

(34) Determination of r sin and resin cont nt

(35) Oily and fatty matter

(36) Solvent extract

(37) Scouring loss

(38) Degumming loss

(39) Free formaldehyde content

(40) pH value of extract liquid

(41) Barium activity count

(42) Permissible ironing temperature

(43) Glossiness

(44) Comparison of colors

(45) Forgins matter and nep

(46) Shrinkage percentage

(47) Shrinkage percentage by ironing

(48) Pilling

(49) Snag

(50) Pile retention

(51) Flammability

(52) Electrostatic propensity

(53) Water resistance

(54) Water vapor permeability

(55) Color fastness

(56) Migration of dyestuffs and finishing agents

(57) Dyestuff class

(58) Fluorescent brightening agents class

(59) Mixture ratio

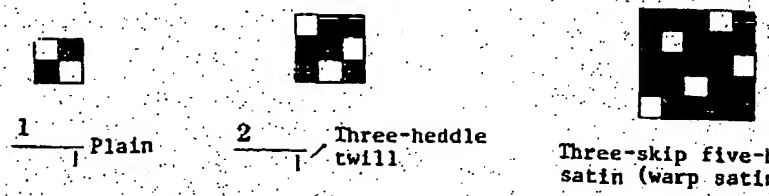
(60) Seam strength

(61) Bagging property

Remark: For the test items of (22), (24), (34), (39) and (46) to (63), appropriate Standards specified independently are cited.

6. Test Methods

6.1 Weave Sample a specimen of an appropriate size from the sample prepared in accordance with 3., and draw the weave construction either by unraveling the warp and weft yarns one after another from the test specimen or by employing a textile analyzing glass, and determine the weave by the aid of figure thus prepared. The weave shall be expressed by the combination of warps and wefts in figure, letter or symbol.



6.2 Width Place the fabric on a flat table, stretch it to remove unnatural creases and tension, measure the distance (cm) between both selvage terminals with a scale placed at five different positions ([4]) at right angles to the selvages, and express the width by the average distance to one place of decimals.

Note ([4]) For wool fabrics, measure at three positions.

Remark: When the measurements are made for the distance excluding one selvage or both selvages, a statement to that effect shall be made in the test report.

6.3 Length Place the fabric on a flat table, stretch it to remove unnatural creases and tension, and measure the overall length (m) to two places of decimals.

Remarks 1. Incomplete parts existing at both ends shall be excluded from the measurement.

2. When a length measuring machine is used, a set scale shall be the standard practice.

6.4 Mass per Unit Area

6.4.1 Corrected Mass Take three test specimens, ach measuring approximately 20 cm × 20 cm ([5]) ([6]), from the sample having been prepared in accordance with 3., measur the absolute dry mass (g) of each specim n, obtain the corrected mass by the use of the formula below, and express the averate corrected mass per one squre meter (g/m^2) to the first decimal plac .

$$\text{Corrected mass } (g/m^2) = W' \times \left(1 + \frac{R}{100}\right) \times \frac{1}{A}$$

where, W' : absolute dry mass (g)

R : official regain (%)

A : area of specimen (m^2).

Note (^{5}) For wool fabrics, take two test specimens, each measuring 25 cm × 25 cm.

(^{6}) The number of specimens may be increased as required by the business consideration, to be noted in the test report.

6.4.2 Mass per Unit Area under Standard Condition Take three test specimens, each measuring 20 cm × 20 cm, from the sample having been prepared in accordance with 3., measure the mass (g) of each specimen under the standard condition, and express the average mass (g/m^2) per one square meter to the first decimal place.

Remarks 1. For wool fabrics and jute fabrics, the mass per unit area under standard condition shall be expressed either in Metsuke or in mass per piece of fabric to the first decimal place. Metsuke shall be obtained from the following formula to be expressed by the mass per 1 m^2 (g/m^2) to the first decimal place.

$$\text{Metsuke } (g/m^2) = \frac{W}{L \times S}$$

where, W : mass of one piece (g)

L : length (m)

S : width (m).

2. For silk fabrics, Metsuke is defined as the value obtained from the degummed mass of 22.8 m length and 3.8 cm width divided by 3.75, and it shall be obtained to the first decimal place as follows.

$$\text{Metsuke} = \frac{W}{L \times S} \times \frac{22.8 \times 3.8}{3.75} = \frac{W}{L \times S} \times 23.1$$

where, W : mass of one piece (g)

L : length (m)

S : width (m).

6.5 Thickness M asure the thickness (mm) at five position of a test specimen having been prepar d in accordance with 3. with a thickness measuring implement under the initial test force (^{8}) applied for a definit time (^{7}), and express an average thickness to two places of decimals. Wh n the test is performed under conditions other than th specific conditions, the test condition shall be noted in the test report.

Notes ([7]) The definite time herein stated means the duration of time which the fabric under the specified pressure requires to have a stabilized thickness. Ordinarily 10 min is preferable.

([8]) Pressure of 23.5 kPa {240 gf/cm^2} applies to ordinary fabrics, and pressure of 0.7 kPa {7 gf/cm^2} to raised or pile fabrics.

6.6 Density Place the sample prepared in accordance with 3. on a flat stand, remove unnatural wrinkles and tension, count the number of the warp and weft yarns at five different positions in an appropriate range ([9]) of the test specimen, and obtain each average value per unit length to one place of decimal.

Further, sample, as required, a specimen of an appropriate size normally to the warp and weft yarn directions from the sample prepared in accordance with 3., unravel the warp yarns and weft yarns out of the specimen, count the number of yarns in each of them, and obtain the density per unit length.

Note ([9]) The appropriate range is defined as 5 cm, 3 cm, 2.54 cm, etc.

Remark: For wool fabrics, the following procedure shall be the standard practice. Take four test specimens, each measuring 2.5 cm × 2.5 cm, at right angles separately to the warp and weft directions, unravel the warp yarns and weft yarns out of the specimens, count the number of warp and weft yarns in each specimen, and express as a rule, the density of warp and of weft per 10 cm by the total number of warps and wefts contained in the four specimens.

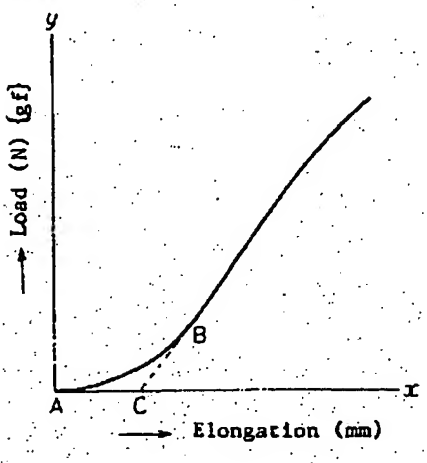
6.7 Crimp Percentage of Yarn

6.7.1 Method A Take two strip-shaped specimens approximately 35 cm in length, each in the warp and weft directions, from two places of the sample having been prepared in accordance with 3., mark at two positions 250 mm apart, and unravel five yarns each from the specimens with care not to untwist the yarns nor to stretch them. On a single yarn tension tester with autographic recorder, set the clamping distance at 250 mm, and make up the initial load - elongation curve as shown in Fig. 1. Draw a tangent touching the curve at the curved point B, obtain the point C of the tangential line intersecting the abscissa x, and calculate the crimp shrinkage from the formula below. Express the crimp shrinkage to one place of decimlas as average of 10 measurements each made for warp and weft yarns.

$$\text{Crimp percentage } (\%) = \frac{AC}{250} \times 100$$

where AC: crimp length (mm).

Fig. 1. Load-elongation Curve



6.7.2 Method B Mark the sample having been prepared in accordance with 3. at three positions 200 mm apart, each in the warp and weft directions, unravel the warp and weft yarns existing within the ranges between the marks, measure the length (mm) of the yarns tautened straight under the initial load ([10]), and obtain the crimp percentage (%) from the formula below.

Measure each five warp and weft yarns at one position, and express the crimp percentage as average of three positions each for the warp and weft yarns to be calculated to one place of decimals.

$$\text{Crimp percentage } (\%) = \frac{L - 200}{200} \times 100$$

where L: length of yarn when tautened straight (mm).

Note ([10]) The "initial load" is a load under which the yarn is kept straight, but not elongated. As the initial load, a load corresponding to the yarn length of 250 m shall be used for spun yarn, and a load equal to $\frac{49}{50}$ mN per 0.11 tex { $\frac{1}{10}$ gf per 1 D} of indicated fineness shall be used for filament yarn. When these loads are not suitable, other loads actually used for the measurement shall be noted in the test report.

6.8 Structure of Yarn Used

6.8.1 Yarn Number Count, Fineness and Lubrication

(1) Apparent Yarn Count and Fineness Take three test specimens, each measuring 20 cm × 20 cm ([11]), from the sample having been prepared in accordance with 3., unravel 25 lines each of warp and weft yarns from each specimen, and weigh the mass (mg). Obtain the apparent yarn count or fineness ([12]) by the formula below and express the apparent yarn count or finen ss to one place of decimals as average of three measurements each made for the warp and weft yarns.

$$\text{Cotton count} = \frac{2\,952.7}{W} \times \left(1 + \frac{P}{100}\right)$$

$$\text{Metric count} = \frac{5\,000}{W} \times \left(1 + \frac{P}{100}\right)$$

$$\text{Flax count} = \frac{8\,267.7}{W} \times \left(1 + \frac{P}{100}\right)$$

$$\text{Jute count} = 0.005\,8 \times W \times \left(1 + \frac{P}{100}\right)$$

$$D = \frac{1.8 \times W}{1 + \frac{P}{100}}$$

$$\text{tex} = \frac{0.2 \times W}{1 + \frac{P}{100}}$$

where, W : mass of 25 yarns tested (mm)

P : crimp shrinkage (%)

D : denier

tex : tex.

Notes (11) The specimens shall be prepared by inserting the sample between two metallic plates measuring 20 cm × 20 cm and then by cutting off the part protruding from the metallic plates.

(12) The "apparent yarn count or fineness" herein stated means the yarn count or fineness of yarns unraveled from the specimen.

Remark: Desizing and the like should be performed if necessary. The desizing method shall be as specified in 6.33.

(2) Indication of Yarn Number Count, Fineness and Blending Ratio

(a) Indication of Yarn Number Count As specified in 3.1 of JIS L 1095.

(b) Indication of Fineness As specified in 3.1 of JIS L 1013.

(c) Indication of Blending Ratio As specified in 3.2 of L 1095.

6.8.2 Twist Number, Percentage of Twist Shrinkage and Indication of Twist

(1) Twist Number The twist number of yarns unravel d from the sample prepared in accordance with 3. shall be as specified in 7.15 of JIS L 1095.

(2) Percentage of Twist Shrinkage As specified in 7.16 of JIS L 1095.

(3) Indication of Twist As specified in 3.3 of JIS L 1095.

6.9 Moisture Regain Take three test specimens ([6]) ([13]) 20 cm × 20 cm from the sample in accordance with 3., weigh each mass (g) before drying and each absolute dry mass (g), obtain moisture regain (%) fr m the following formula, and express as average calculated to one place of decimals.

$$\text{Moisture regain } (\%) = \frac{W_1 - W_2}{W_2} \times 100$$

where, W_1: mass before drying (g)

W_2: absolute dry mass (g).

Note ([13]) For silk fabrics and wool fabrics, two test speicmens shall be sampled.

Informative Reference:

$$\text{Moisture content } (\%) = \frac{W_1 - W_2}{W_1} \times 100$$

where, W_1: mass before drying (g)

W_2: absolute dry mass (g).

6.10 Apparent Specific Gravity and Pore Volume

6.10.1 Apparent Specific Gravity Obtain the apparent specific gravity from the formula below on the basis of the results obtained in 6.4.2 and 6.5 (to two places of decimals).

$$\text{Apparent specific gravity} = \frac{W}{1000 \times t}$$

where, W: mass per square meter under the standard condition (g/m^2)

t: thickness (mm).

6.10.2 Pore Volume Obtain the pore volume from the formula below on the basis of the apparent specific gravity obtained in 6.10.1 and the specific gravity of the fiber.

$$\text{Pore volume } (\%) = \frac{S_1 - S_2}{S} \times 100$$

where, S_1: specific gravity of fiber

S_2: apparent specific gravity.

Informative Reference: The specific gravity of fiber shall be as specified in JIS L 1030.

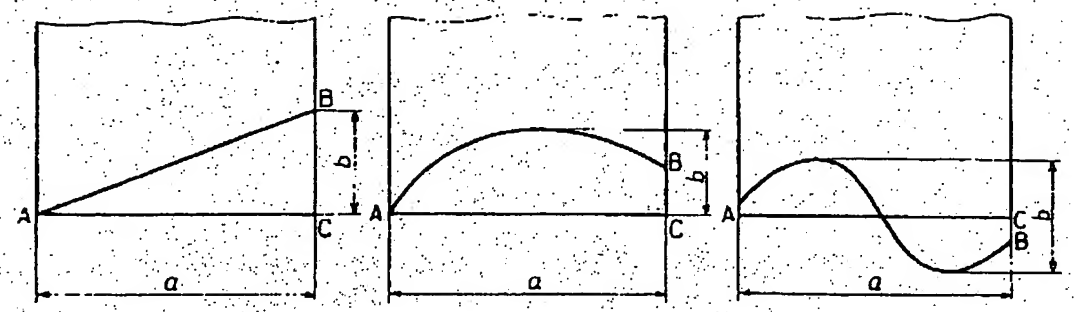
6.11 Bowing Draw a w ft line AB from on sid selvage end A of a fabric to the ther selvage end B along the weft line as given in Fig. 2, at three different positions of the sample prepared in accordance with 3. Then, draw a line from A normally to the selvage end, take the point at which the line intersects the other selvage end as C, and obtain a length a (cm) of line AC (width). Measure the maximum bias distance b (cm) between AC as given in Fig. 2, obtain the bowing (%) from the following formula, and express it as average of those at three different positions (to one place of decimals).

$$\text{Bowing (\%)} = \frac{b}{a} \times 100$$

where, a: width (cm)

b: maximum bias distance (cm).

Fig. 2. Classification of Bowing



6.12 Tensile Strength and Elongation Percentage

6.12.1 Test Methods under Standard Condition The test under the standard condition shall be carried out by method A and method B.

(1) Method A (Strip Method) This method includes two methods, the unraveled strip method and the cut strip method. When the unraveled strip method is used, the test specimens shall be prepared in accordance with 3. in any condition given in Table 2, and approximately the equal number of yarns shall be removed from both sides to attain the specified width. When the cut strip method, which is applicable to the special fabrics unfit to the unraveled strip method, is used, the test specimens shall be cut, from the sample prepared in accordance with 3., to the specified width given in Table 2 along the yarns.

Next, clamp a test speicmen with clamping jaws of a textile tension tester under the initial load ([14]), then make the test in any way given in Table 3, and measure the breaking strength (N) {kgf} and elongation percentage (%). Express the tensile strength and elongation percentage as average of three measurements ([15]) made each in the warp and weft directions to be calculated to three significant figures. How ver, cases f test specimens which break within 1 cm from the clamping jaw or cut abnormally shall be excluded from the test report.

Test conditions shall be annexed to the test report.

Notes ([14]) Although a load equivalent to a 10 m specimen should be used in ordinary cases, a different load may b used, with a note appended.

([15]) Th standard number of tests specified her may be increased as required for business consideration, with th number of tests noted in the test results.

Table 2. Preparation of Specimen

Nature of fabric		Size of specimen when cut for preparation (width in cm x length in cm)	Width of specimen cm	Number of specimens
Ordinary fabric		Approx. 5.5 x approx. 30	5	3
		Approx. 3 x approx. 20	2.5	
Heavy fabric	60 yarns/5 cm or over in density	Approx. 4 x approx. 30	3	3
	60 yarns/under 5 cm in density	Approx. 5 x approx. 30		

Table 3. Test Conditions

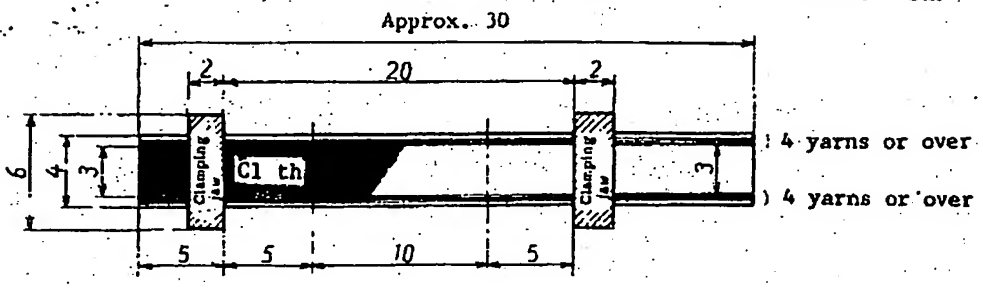
Type of tester	Nature of fabric	Width of specimen cm	Clamping distance cm	Rate of stretching
Constant traverse rate	Ordinary fabric	5	20 ([16])	15 ± 1 cm/min or 30 ± 2 cm/min
	Ordinary fabric	2.5	10	
	Heavy fabric	3	20	20 ± 1 cm/min
Constant loading rate type	All fabrics	3 or 5	20	Loading whole capacity in a minute
Constant extension rate type	Ordinary fabric	5	20	Rate of approx. 50 % or 100 % of clamping distance per minute
	Ordinary fabric	2.5	10	
	Heavy fabric	3	20	

Note ([16]) This distance shall be altered to 15 cm for wool fabrics.

Remark 1. For heavy fabrics, if the yarns on both sides tend to stick out of the cloth in the course of the test, retain four or more yarns on each side of the 3-cm width and then cut the yarns at 5 cm from the ends of clamping jaws as shown in Fig. 3 to make into test specimens.

Fig. 3. Preparation of Specimens

Unit: cm



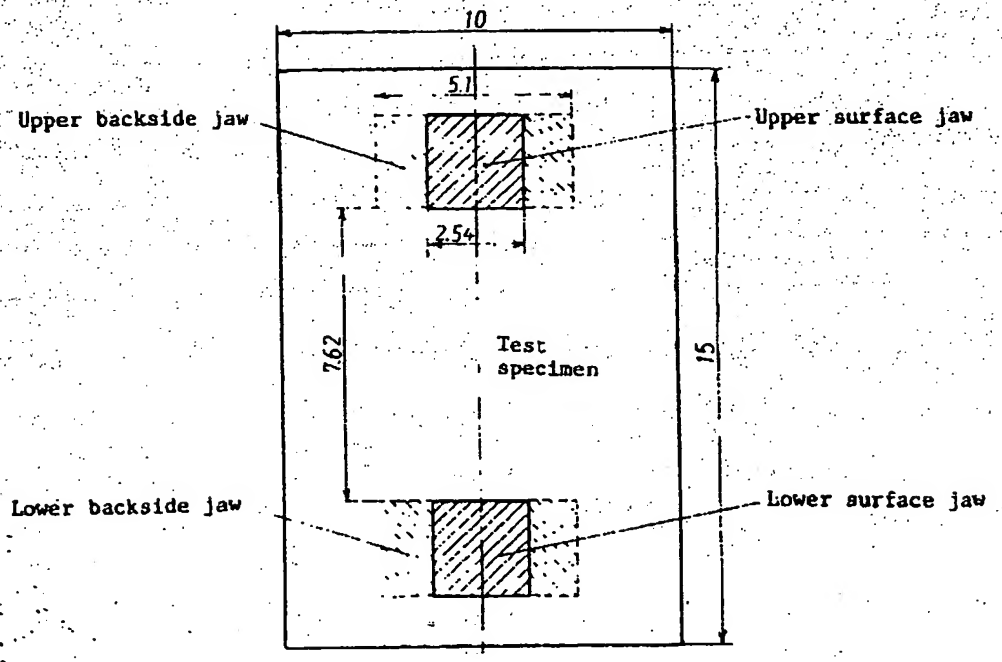
2. When load at cutting is not a maximum load, the maximum l ad (N {kgf}) and elongation (%) at that time shall be measured.

(2) Method B (Grab Method) Take three test specimens from the sample prepared in accordance with 3., each measuring 10 cm in width and 15 cm in length, so that the longitudinal direction of the specimens to be tested for the warp direction may be in parallel with the warp direction of the sample and that the longitudinal direction of the specimens to be tested for the weft direction may be in parallel with the weft direction.

Using a textile tension tester having an appropriate performance, clamp a specimen with the clamping distance of 7.6 cm, and with the clamping area for the surface of 2.54 × 2.54 or over and the clamping area for the backside of 5.1 × 2.54 cm or over, for both the upper and the lower clamping jaws, as shown in Fig. 4, applying the specified initial load ([14]). Stretch the specimen at a tension speed of 30 ± 2 cm per minute to obtain the breaking strength (N {kgf}) and elongation percentage (%). Express th tensile strength and elongation percentage as average of three measurements ([15]) made each in the warp and weft directions in three significant figures. The test result of a test specimen which breaks within 1 cm from the jaw or cuts abnormally shall be discarded. Test conditions shall be noted in the test report.

Fig. 4. Preparation of Specimen

Unit: cm



6.12.2 Test Method under Wet Condition Take a test specimen in the sam way as in 6.12.1, and put it in a separate container. Leave it until it is submerged under water (20 ± 2°C) by its own mass or immerse it in water for one hour or longer. For the specimen difficult to moist n, it is allowed to use a solution of nonionic surfactant within 0.1 % to moisten the specimen thoroughly. In this case, it is necessary to rinse the specimen

thoroughly, with wat r prior to th test. Aft r taking the specimen out of water, obtain its tensile strength (N {kgf}) and elongation (%) in the same way as in 6.12.1 within 1 min.

6.13 Elongation Elastic Modulus

6.13.1 Method A Take three test specimens from a sample having been prepared in accordance with 3. in the same way as in 6.12, each in the warp and weft directions. Using a constant extension rate type tension tester with an autographic recorder, apply the specified initial load ([14]), stretch the specimen with the clamping distance of 20 cm at a tension speed of 10 % of the clamping distance per minute to the specified elongation ([17]), and leave it still for 1 min.

Next, remove the load at the same rate, leave it still for 3 min, and then stretch again the specimen to the specified elongation. Meaaure the residual elongation on the recorded load-elongation curve (see Fig. 5), and obtain the elongation elastic modulus by the formula below. Express the elongation elastic modulus as average of three measurements ([15]) made each in the warp and weft directions to a digit of integer. Test conditions shall be noted in the test report.

$$\text{Elongation elastic modulus } (\%) = \frac{L - L_1}{L} \times 100$$

where, L: specified elongation (mm)

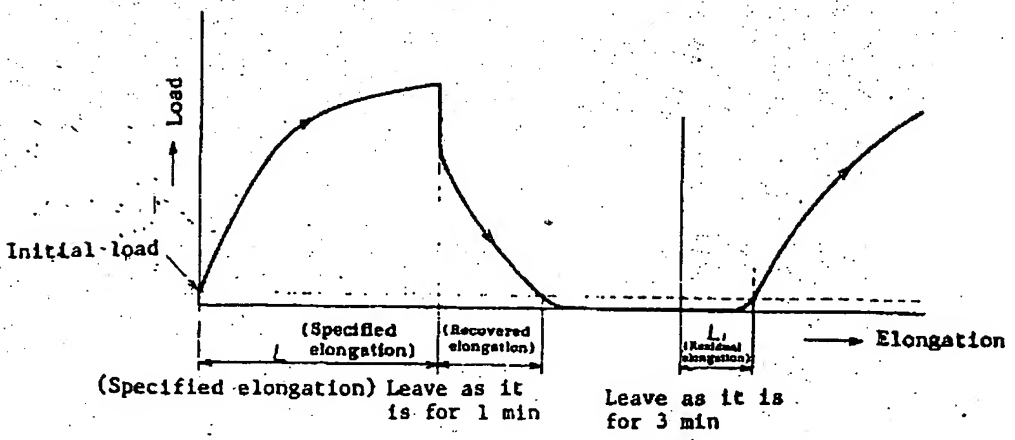
L_1: residual elongation (mm).

Note ([17]) The specified elongation shall be either 3 % or 5 %.

Remarks 1. The preferable load range on the recording paper should be such that the load for the specified elongation reaches at least 50 % of the full scale.

2. The speed of the recording paper shall be so predetermined that the specified elongation corresponds a length of at least 5 cm on the recording paper.

Fig. 5. Load-elongation Curve



Informative Reference: Repetitionary Elongation Elastic Modulus Repeat the same procedure as Method A to a specimen five or ten times under the same condition as for Method A, and obtain the repetitionary elongation elastic modulus by the formula for Method A. Express the repetitionary elongation elastic modulus as average of three measurements made each in the warp and weft directions. The test report shall incude the number of repetitions of elongation.

6.13.2 Method B Take five test specimens from a sample in the same way as in 6.12 each in the warp and weft directions. Using a tension tester, stretch the specimen to 10 mm (i.e. 5 % of the original length), remove the load immediately after leaving it as it is for 1 minute, and leave it as it is further for 3 min. Apply the initial load ([14]), measure the residual elongation, and obtain the elongation elastic modulus by the use of the formula below. Express the elongation elastic modulus to a digit of integer as average of five measurements ([15]) made each in the warp and weft directions.

$$\text{Elongation elastic modulus } (\%) = \frac{10 - L_1}{10} \times 100$$

where L_1: residual elongation (mm).

6.14 Stretchability of Stretch Fabrics

6.14.1 Stretch Percentage

(1) Method A (Constant Extension Rate Method) Take three test specimens ([19]) each in the warp and weft directions from a sample which has been prepared in accordance with 3. maintaining the stability of change in dimension ([18]). Fix a specimen to a constant extension rate type tension tester with autographic recorder so that the clamping distance is either 20 cm or 50 cm under the initial load ([20]). Operate the tester to draw a load-elongation curve at a tension speed of 100 % of the clamping distance per minute. Obtain the stretch percentage (%) under the load of 14.71 N {1.5 kgf} ([21]) on the curve. Express the stretch percentage (%) as average of three measurements ([15]) to one place of decimals.

Notes ([18]) A state of stabilized dimensional change means a state in which, when the sample is subjected to two successive measurements made for an arbitrary length or width at an interval of 24 h or longer, the difference between the two measurements has come to within 0.3 % of the latter value of length or width measured.

([19]) First cut the specimen into a size of approximately 6 × approximately 30 cm or a size of approximately 6 cm × approximately 60 cm, and then remove about the same number of yarns from both sides of width to make into a width of 5 cm. In the test report, record the length tested.

([20]) Th initial load shall, as a rule, be equivalent to a l ad (N{kgf}) exerted on a sample measuring 1 meter in length and of th same width as that of the specimen, obtain d to a digit of integer. Other initial loads, if used, shall be recorded in th test report.

([21]) Loads other than 14.71 N {1.5 kgf} may be used, as required, and the load, if used, shall be noted in the test report.

Remark: The test methods prescribed in 6.14 apply mainly to stretch fabrics. The stretch fabrics are those endowed particularly with a stretch property either by weaving stretch yarns (for example, stretechable bulky processed yarns of chemical fiber and polyurethane yarns) or by other means.

(2) Method B (Constant Load Method) Prepare the test specimens as described in Method A and use an appropriate tension tester or an equivalent. Fix one end of a specimen with the upper clamp and apply the initial load ([20]) to the other end. Put bench marks 20 cm or 50 cm apart on the specimen, apply the load of 14.71 N {1.5 kgf} ([21]) gently, leave the specimen still for 1 min ([22]), measure the distance (cm) between the bench marks, and then obtain the stretch percentage (%) to one place of decimals as average of three measurements ([15]).

$$\text{Stretch percentage } (\%) = \frac{L_1 - L_0}{L_0} \times 100$$

where, L_0: original distance between bench marks (20 cm or 50 cm)

L_1: distance between bench marks after left to stand for 1 min subsequent to a load of 14.71 N {1.5 kgf}.

Note ([22]) The duration of leaving to stand may be altered, as required, with the duration adopted recorded in the test report.

(3) Method C (Cyclic Constant Load Method) Apply the initial load to the test specimens as described in Method A, and then put the bench marks 20 cm or 50 cm apart as described in Method B. Then apply a load of 14.71 N {1.5 kgf} ([21]) starting from no load, and remove the load in 5 s. Repeat this cycle four times, then apply the fifth additional load, and measure the distance (cm) between the bench marks after leaving the specimen as it is for 30 s. Calculate the stretch percentage (%) by the use of the formula below, and express it as average of three measurements ([15]) to one place decimals.

$$\text{Stretch percentage } (\%) = \frac{L_1 - L_0}{L_0} \times 100$$

where, L_0: original distance between bench marks (20 cm or 50 cm)

L_1: distance between bench marks having been left as it is for 30 s after the fifth loading (cm).

6.14.2 Stretch Recovery Percentage and Residual Strain Percentage
The stretch recovery percentage and residual strain percentage shall be as described in the following (1) to (4) methods.

(1) Method A (Cyclic Constant Extension Rate and Limited Stretch Method) Prepare a specimen as described in Method A of 6.14.1, use a constant extension rate type tension tester with autographic recorder, and fix the specimen to the tester with a clamping distance of 20 cm or 50 cm under the initial load. Stretch the specimen at a tension speed of 100 % of the clamping distance per minute until the specimen reaches 80 % ([23]) of the stretch obtained by Method A of 6.14.1, leave it still for 1 min, then allow the speicmen to return to its original position at the same speed, and leave it as it is for 3 min. Repeat this sequence ten times ([24]), then stretch the specimen again at the same rate as above to allow the tester to draw a load-stretch curve as shown in Fig. 6. Obtain the stretch recovery percentage (%) and residual strain percentage (%) on the curve thus obtained by the use of the formula below. Express the stretch recovery percentage (%) and residual strain percentage (%) as average of three measurements ([15]) to one place of decimals.

$$\text{Stretch recovery percentage } (\%) = \frac{L_{10} - L'_{10}}{L_{10}} \times 100$$

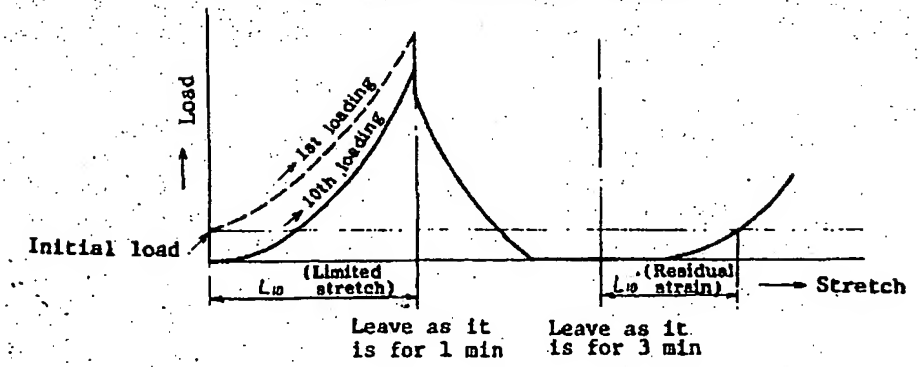
$$\text{Residual strain percentage } (\%) = \frac{L'_{10}}{L_0} \times 100$$

where, L_{10}: stretch equivalent to 80 % of stretch obtained by Method A of 6.14.1 (cm)

L'_{10}: residual strain after ten cycles of loading and unloading (cm),

L_0: origianl distance between two clamps (20 cm or 50 cm).

Fig. 6. Load-extension Curve

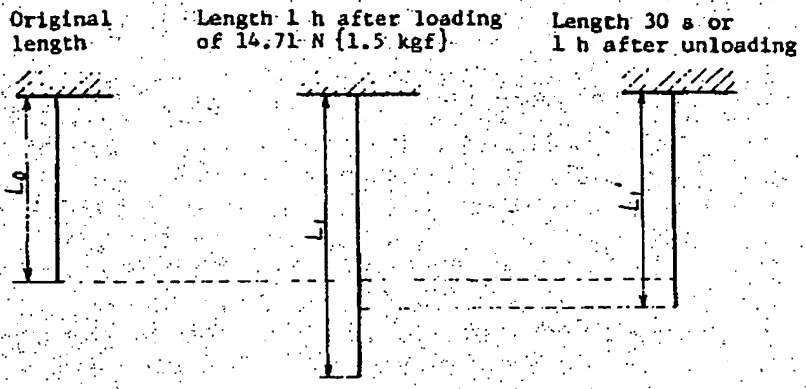


Notes ([23]) Other stretches, if required, may be adopted, with a note in the test report.

([24]) Th cycle may be altered to others as required, with a due statement in the test report.

(2) Method B 1 (Constant Load Method) Prepare a specimen as described in Method A of 6.14.1. Using a tension tester with autographic recorder or an apparatus at least equal thereto in performance, fix one end of th specimen to th upper clamp of the tester, apply the initial load ([20]) to the other end, and put the bench marks 20 cm or 50 cm apart on the specimen. Apply a load f 14.71 N {1.5 kgf} ([21]) gently, leave the specimen as it is for 1 h ([22]), and then measure the distance (cm) between the bench marks. Unload the load, apply the initial load again 30 s later and 1 h later respectively, and measure the distance between the bench marks (see Fig. 7). Obtain the stretch recovery percentage (%) and residual strain percentage (%) by the use of the formula below. Express the stretch recovery percentage and residual strain percentage each 30 s and 1 h after unloading as average of three measurements ([15]) to one place of decimals. The duration of time the specimen was left as it is after unloading shall be noted in the test report.

Fig. 7



$$\text{Stretch recovery percentage } (\%) = \frac{L_1 - L'_1}{L_1 - L_0} \times 100$$

$$\text{Residual strain percentage } (\%) = \frac{L'_1 - L_0}{L_0} \times 100$$

where, L_0 : original distance between bench marks (20 cm or 50 cm)

L_1 : distance between bench marks 1 h after loading of 14.71 N {1.5 kgf} (cm),

L'_1 : distance between bench marks when initial load is applied 30 s or 1 h after unloading (cm).

(3) Method B-2 (Limited Stretch Method) Prepare a specimen as described in Method A of 6.14.1, apply the initial load as described in Method B 1 above, and put the bench marks 20 cm or 50 cm apart on the specimen. Stretch the specimen until its stretch reaches 80 % ([23]) of that obtained by Method B of 6.14.1, leave it still for 1 h ([22]), and then unload th load. Apply the initial load 30 s and 1 h after unloading, and measure the distance (cm)

between the bench marks each time. Obtain the stretch recovery percentage (%) and the residual strain percentage (%), each measured 30 s and 1 h after unloading, by the use of the formula below, and express them to one place of decimals as average of three measurements ([15]). The duration of time the specimen is left as it is after unloading shall be recorded in the test report.

$$\text{Stretch recovery percentage } (\%) = \frac{L_1 - L'_1}{L_1 - L_0} \times 100$$

$$\text{Residual strain percentage } (\%) = \frac{L'_1 - L_0}{L_0} \times 100$$

where, L_0: original distance between bench marks (20 cm or 50 cm)

L_1: distance between bench marks when stretch of specimen reaches 80 % of that obtained by Method B of 6.14.1 (cm)

L'_1: distance between bench marks when the initial load is applied 30 s or 1 h after unloading (cm).

(4) Method C (Limited Stretch Method) Prepare a specimen as described in Method A of 6.14.1, apply to it the initial load as described in Method B 1 above, and put the bench marks 20 cm or 50 cm apart on it. Stretch the specimen until its stretch reaches 80 % ([23]) of that obtained by Method C of 6.14.1, leave it still for 1 h ([22]), and then unload the load. Apply the initial load 30 s and 1 h after unloading, followed each time by measuring the distance (cm) between the bench marks. Obtain the stretch reocvery percentage (%) and the residual strain percentage (%) by the use of the formula below, to one place of decimals, as average of three measurements ([15]) each made 30 s and 1 h after unloading. The duration of time the specimen is left as it is after unloading shall be recorded in the test report.

$$\text{Stretch recovery percentage } (\%) = \frac{L_1 - L'_1}{L_1 - L_0} \times 100$$

$$\text{Residual strain percentage } (\%) = \frac{L'_1 - L_0}{L_0} \times 100$$

where, L_0: original distance between bench marks (20 cm or 50 cm)

L_1: distance between bench marks when stretch of specimen reaches 80 % of that obtained by Method C of 6.14.1 (cm),

L'_1: distance between bench marks when the initial load is applied 30 s or 1 h after unloading (cm).

6.14.3 Stretch Property Pr pare a specimen as describ d in Method A of 6.14.1, and put it on an autographic constant ext nsion rate type tension tester with 20 cm r 50 cm apart b tween two clamps under the initial load. Stretch the specimen at a tension speed of 100 % of the clamping distance per minute until its elongation reaches 80 % ([23]) of that obtained by Method A of 6.14.1, and obtain the load (N {gf}) at this time from the load elongation curve. Express the stretch property to one plac of decimals as average of three measurements ([15]).

6.14.4 Percentage of Stress Relaxation Percentage of stress relaxation shall be obtained by either of the two methods (1) and (2) described below.

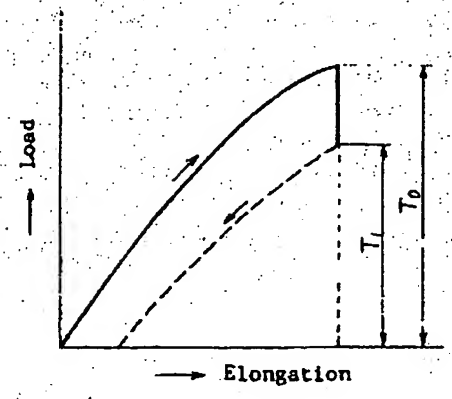
(1) Method A (One-time Loading Method) Prepare a specimen as described in Method A of 6.14.1, and put it on an autographic constant extension rate type tension tester with 20 cm or 50 cm apart between two clamps under the initial load. Stretch the specimen at a tension speed of 100 % of the clamping distance per minute until its elongation reaches 80 % ([23]) of that obtained by Method A of 6.14.1, and leave it as it is for 10 min. Draw the load-elongation curve as shown in Fig. 8, and obtain the percentage of stress relaxation (%) by the use of the formula below. Express the percentage of stress relaxation to one place of decimals as average three measurements ([15]).

$$\text{Percentage of stress relaxation } (\%) = \frac{T_0 - T_1}{T_0} \times 100$$

where, T_0: load when specimen reaches 80 % of that obtained by Method A of 6.14.1 (N {gf})

T_1: load after leaving specimen as it is for 10 min (N {gf}).

Fig. 8. Load-elongation Curve



(2) Method B (Cyclic Loading Method) Prepare a specimen as described in Method A of 6.14.1. Stretch the specimen until its elongation reaches 80 % ([23]) of that obtained by Method A of 6.14.1, and then leave it as it is for 1 min. Then restore the specimen to the original position leaving it as it is for 3 min. Repeat this sequence and, at the 10 th cycle ([24]), leave the specimen as it is

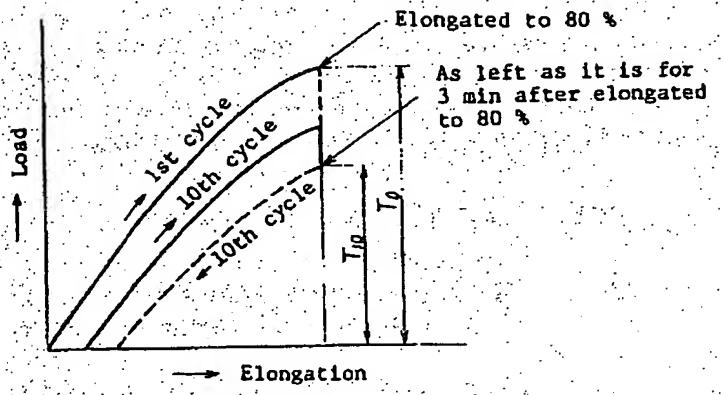
for 3 min after its elongation reaches 80 % ([23]) of that prescribed. Allow th tester to draw thereby the load-elongation curve as shown in Fig. 9, and obtain the percentage of stress relaxation (%) by the use of the formula below to one place of decimals as average of three measurements ([15]).

$$\text{Percentage of stress relaxation } (\%) = \frac{T_0 - T_{10}}{T_0} \times 100$$

where, T_0: load under which specimen is initially elongated to 80 % of that obtained by Method A of 6.14.1 (N{gf})

T_{10}: load under which specimen is left still for 3 min after the tenth elongation (N{gf}).

Fig. 9. Load-elongation Curve



6.15 Tearing Strength

6.15.1 Method A-1 (Single-tongue Method) Take three test specimens, each measuring 5 cm × 25 cm, from the sample having been prepared in accordance with 3. each in the warp and weft directions, and give each a cut 10 cm in length at right angles to the short side in the middle of it. Using a tension tester having clamps 5 cm or more in width, hold each tongue-shaped specimen at right angles to the clamps with a clamping distance of 10 cm. Stretch the specimen at a tension speed of 15 cm or 20 cm per minute, and obtain the maximum load (N{kgf}) indicated when the specimen is torn. Express the average tearing strength of the weft yarns and the warp yarns each to one place of decimals. The test report shall include the test conditions.

Remark: The tearing strength of weft yarns means that indicated by the weft yarns when they are torn, and the tearing strength of warp yarns the strength indicated by the warp yarns when they are torn.

If tearing takes place abnormally, it shall be noted in the test report.

6.15.2 Method A-2 (Single-tongue Method) This method is applicable mainly to wool fabrics.

Take five test speicmens, each measuring 7.5 cm × 20 cm, each in the warp and weft directions from the sample having been prepared in accordance with 3., and give the specimen a cut 8 cm in length at right angles to the short side in the middle of it. Using a tension tester with autographic recorder, having clamps 7.5 cm or more in width, hold each tongue-shaped specimen at right angles to the clamps with a clamping distance of 7.5 cm.

Stretch the specimen at a tension speed of 5 cm per minute, and continue the measurement for 60 s reckoning from the point of tearging apart 0.5 cm from the first maximum point. Express the tearing strength by one of the methods described below.

(1) Mean Value of Five Greatest Values Obtain the greatest values for each of the five equal parts of 1.25 cm divided except for 0.5 cm from the first maximum point. Average the greatest values thus obtained.

(2) Mean Value Obtained by Integrator Obtain the mean value by the use of the formula below.

$$\text{Tearing strength (N \{kgf\})} = \frac{X \times W}{K}$$

where, X: reading of integrator

W: load of full scale (N {kgf})

K: constant given by reading of integrator 60 s after deflection of recorder pen falls in line with full scale under condition where input of integrator is constant.

(3) Median Peak Load Count and mark the greatest values registered in a 5-cm distance which the cross head has moved from the place 0.5 cm apart from the first maximum point.

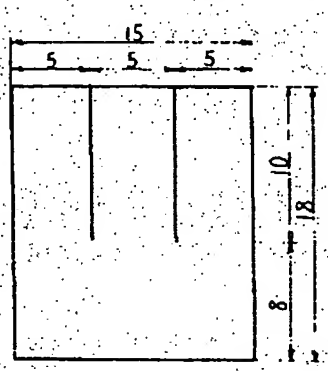
Move a transparent scale in parallel with the abscissa (time) on the recording paper so that the peaks may be divided into the same number each for the upper half and the lower half. The position thus obtained on the ordinate indicates the median peak load.

6.15.3 Method B (Double-tongue Method) Take three test specimens ([6]), measuring 15-cm × 18 cm, each in the warp and weft directions from the sample having been prepared in accordance with 3., and give each of the specimens a cut 10 cm in length at right angles to the short side at two points trisecting it as shwon in Fig. 10. Using a tension tester having the clamps 15 cm or more in width, clamp the middle tongue-shaped portion with one clamp and the outside tongues with the other clamp at right angles to the clamp with the clamping distanc of 10 cm.

Maintaining the tension speed of 15 cm or 20 cm per minute, measure the maximum load (tearing strength) (N {kgf}) indicated when the specimen is torn longitudinally and laterally leaving a length of 2.5 cm intact. Express the average tearing strength (N {kgf}) each in the warp and weft directions to one place of decimals. Note the tension speed used in the test report.

Fig. 10. Preparation of Test Specimen

Unit: cm



Remark: The tearing strength of weft yarns means that indicated by the weft yarns when they are torn, and the tearging strength of warp yarns the strength indicated by the warp yarns when they are torn.

If tearing takes place abnormally, it shall be noted in the test report.

6.15.4 Method C (Trapezoid Method) Take three test specimens ([6]), measuring 7.5 cm × 15 cm, each in the warp and weft directions from the sample having been prepared in accordance with 3. Draw a trapezoidal mark on each specimen, as shown in Fig. 11, and give the specimen a cut 1 cm in length at right angles to the side in the middle of the short side of the mark. Using a tension tester having the clamps 7.5 cm or over in width, clamp the specimen with a clamping distance of 2.5 cm so as to tauten the short side of the trapezoid and to slacken the long side.

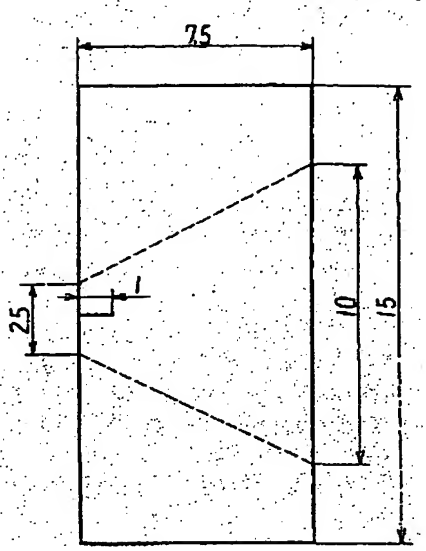
Maintain the tension speed of 15 cm or 20 cm per minute, and measure the maximum load (tearing strength) (N {kgf}) indicated when the specimen is torn. Express the average tearing strength each of the weft yarns and warp yarns to one place of decimals. Note the tension speed used in the test report.

Remark: The tearing strength of weft yarns means that indicated by the weft yarns when they are torn, and the tearing strength of warp yarns the strength indicated by the warp yarns when they are torn.

If tearing takes place abn rmally, it shall be noted in the test report.

Fig. 11. Preparation of Test Specimen

Unit: cm



6.15.5 Method D (Pendulum Method) Take five test specimens measuring 6.3 cm × 10 cm, each in the warp and weft directions from the sample having been prepared in accordance with 3. Using an Elmendorf type tearing strength tester, give each specimen a cut 2 cm in length at right angles to the long side of the specimen in its middle point between both clamps, and measure the load (tearing strength) (N {kgf}) indicated when the remaining 4.3 cm length of the specimen is torn. Express the average tearing strength each of the weft yarns and warp yarns to a digit of integer.

Remark: The tearing strength of weft yarns means that indicated by the weft yarns when they are torn, and the tearing strength of warp yarns the strength indicated by the warp yarns when they are torn.

If tearing takes place abnormally, it shall be noted in the test report.

6.16 Bursting Strength

6.16.1 Method A (Müllen Type Method) Take five test specimens, each measuring approximately 15 cm × approximately 15 cm, from the sample having been prepared in accordance with 3. Using a Müllen type bursting strength tester, hold the specimen, with the surface of test specimen upward, in the clamp with a uniform tension just sufficient to eliminate wrinkles or slackening, and measure the strength (kPa {kgf/cm^2}) of the rubber diaphragm which bursts the specimen under the applied pressure and also the strength (kPa {kgf/cm^2}) of rubber diaphragm when the clamp is removed. Obtain the bursting strength (kPa {kgf/cm^2}) by the formula below, and express it to one place of decimals as average of five measurements.

The diameter of the clamp shall be 3.05 ± 0.03 cm, and generally the oil increasing rate for applying the pressure shall be 98 ± 4 ml/min.

Bursting strength (kPa {kgf/cm²}) = A − B

where, A: strength of rubber diaphragm to burst specimen (kPa {kgf/cm^2})

B: strength of rubber diaphragm when clamp is removed (kPa {kgf/cm^2}).

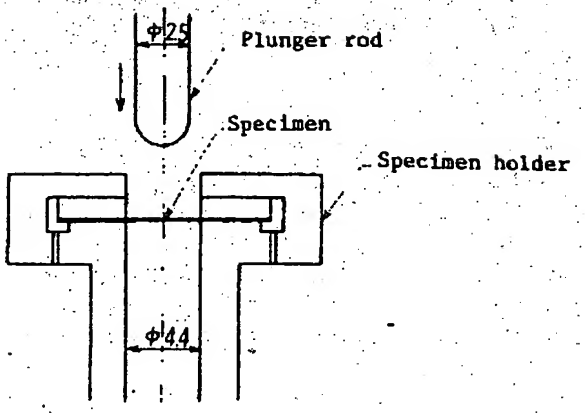
Remarks 1. The rubber diaphragm of the tester shall be the diaphragm of pure rubber material 0.84 to 0.89 mm in thickness containing no mineral fillers.

2. The tester shall have been subjected to calibration by reference aluminium. The quality of reference aluminium shall be 0.1 mm in thickness, 2.71 in specific gravity, 99.96 % in purity, and 13.55 g (100 × 500 mm) in mass, as specified in JIS H 4170. The bursting strength shall be 1.089 MPa {11.11 kgf/cm^2}.

6.16.2 Method B (Constant Extension Rate Type Method) Take five test specimens, each approximately 8 cm in diameter, from the sample having been prepared in accordance with 3. Using a constant extension rate type bursting tester as shown in Fig. 12, apply a uniform tension just sufficient to eliminate creases and slacking to the specimen with its back face facing upwards, and then fix it to the clamp 4.4 cm in inside diameter. Using the plunger rod of 2.5 cm in diameter having the tip end 1.25 cm in radius of curvature, apply the pressure at a rate of 10 cm per minute. Measure the bursting strength (N {kgf}) of the specimen indicated when the plunger rod bursts the specimen under the pressure. Express the bursting strength (N {kgf}) to one place of decimals as average of five measurements.

Fig. 12. Constant Extension Rate Type Bursting Strength Tester

Unit: cm



6.17 Abrasion Resistance

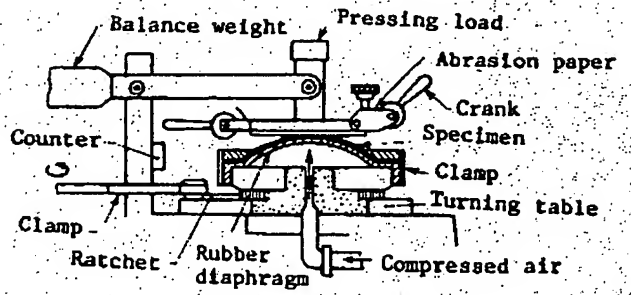
6.17.1 Method A (Universal Type Method) Method A shall be in accordance with any one of the methods (1) to (3) described below.

(1) Method A-1 (Flat Surface Method) Take five test specim ns, each approximately 12 cm in diameter, from the sample having been prepared in accordance with 3., and place the specimen on a rubber diaphragm. Abrade it in varied directions with an abrasion paper ([25]), and count the number of abrasion times ([26]) needed before the paper breaks the specimen. Express the abrasion resistance to a digit of integer as average of five measurements. The abrasion rate shall be 125 ± 5 times per minute, and the pressing load shall be 4.45 N {0.454 kgf}.

The specimen shall be rotated once for every 100 times of abrasion.

The air pressure shall, as a rule, be 2.76×10^4 Pa {0.281 kgf/cm^2}, and any other pressure used shall be noted in the test report.

Fig. 13. Flat Surface Method



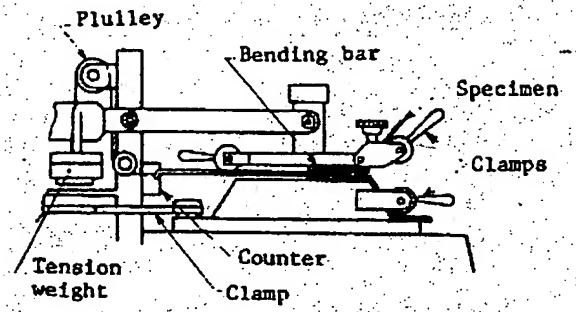
(2) Method A-2 (Bending Method) Take five test specimens, each measuring approximately 3 cm × approximately 20 cm for the density 50 yarns/2.54 cm or over and approximately 4 cm × approximately 20 cm for the density under 50 yarns/2.54 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Remove the same number of yarns each from both sides of the specimen until the width reaches nearest to 2.5 cm to prepare specimens measuring 2.5 cm × 20 cm. Fold the specimen into two, and attach it to the tester astride the bar. Apply the specified tension load ([28]) and pressure load ([29]) while giving reciprocating abrasions over the length of 2.5 cm. Count the number of abrasions needed before the specimen is broken. Express the abrasion resistance to a digit of integer as average of five measurements made each in the warp and weft directions. The abrasing rate shall be 125 ± 5 times per minute.

Generally the adjustment of the load shall be made in accordance with the test conditions in Table 4.

Table 4. Test Conditions

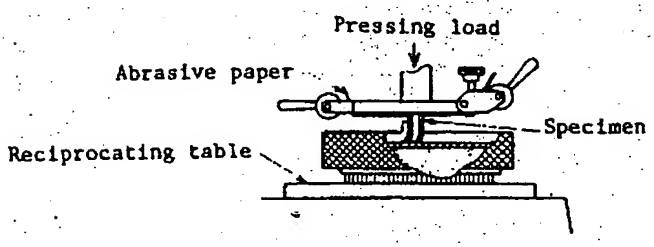
Mass per unit area of fabric g/m²	Tension load [28] N {kgf}	Pressign load [29] N {kgf}
Under 87	8.90 {0.907}	4.45 {0.454}
87~168	13.34 {1.360}	6.67 {0.680}
168~255	17.79 {1.814}	8.90 {0.907}
255~342	22.24 {2.268}	11.12 {1.134}
342~510	26.69 {2.722}	13.34 {1.360}
510 or over	31.14 {3.175}	15.56 {1.587}

Fig. 14. Bending Method



(3) Method A -3 (Fold Method) Take five test specimens, each measuring 2.5 cm × 7.5 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Fix the specimen to the clamp for fold abrasion, as shown in Fig. 15. Apply the pressure load of 2.23 N [0.227 kgf] or 4.45 N {0.454 kgf} to the specimen giving reciprocating abrasions [26] either in one direction or in varied directions with an abrasive paper [25] as in the case of the flat surface abrasion. Count the number of abrasions [27] needed before the specimen is broken. Express the abrasion resistance in a digit of integer as average of five measurements made each in the warp and weft directions.

Fig. 15. Fold Method



Not s [25] For abrasion, the abrasive paper specified in JIS R 6253 shall be used, and its specified number shall b noted in the test report.

[26] The direction of abrasion shall be noted in the test report.

(27) The number of abrasions needed before the specimen breaks means the number of reciprocations indicat d when the tester stops because of the hole produced on the speicmen.

(28) The tension load means a load exerted on the bar, which shall be noted in the test report.

(29) The pressing load means a load applied perpendicularly to the specimen, which shall be noted in the test report.

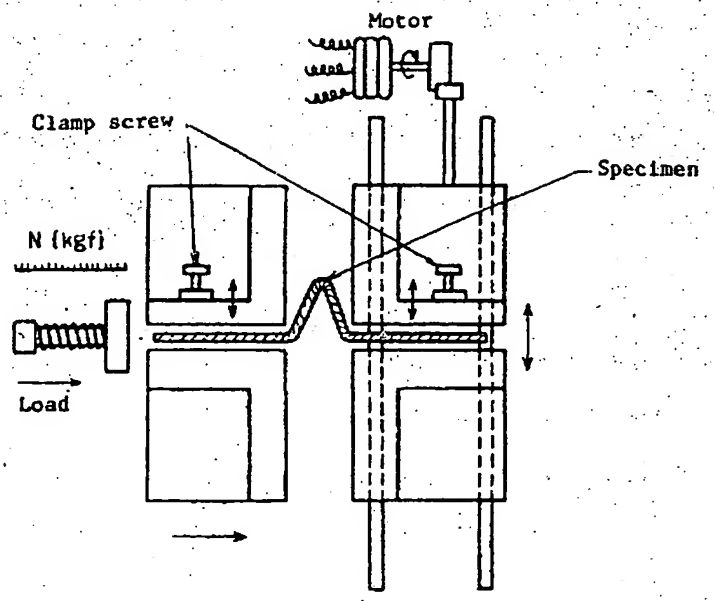
Remark: The width of the abrasion surface of the clamp shall be noted in the test report.

6.17.2 Method B (Scott Type Method) Take five test specimens, each measuring approximately 3 cm × approximately 12 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3., and remove the same number of yarns from both sides of each specimen to make into the size of 2.5 cm × 12 cm. Fix the specimen thus prepared between two clamps, which have been arranged to 2 cm apart in advance, with a Scott type tester shown in Fig. 16. Give the reciprocating abrasion over the distance of 4 cm under the pressing load of 9.81 N {1 kgf} applied to both clamps. Count the number of abrasions (30) needed before the width of the specimen is cut by 1 to 1.5 cm. Express the abrasion resistance to a digit of integer as average of five measurements made each in the warp and weft directions.

The abrasion speed shall be 120 ± 2 times per minute. Any pressing load other than 9.81 N {1 kgf} shall be noted in the test report.

Note (30) For coated fabrics, the abrasion shall be stopped at the completion of 1000 abrasions, and the surface condition at that time shall be examined and noted in the test report.

Fig. 16. Scott Type Tester



6.17.3 Method C (Taber Type Method) Take five circular test specimens, ach 13 cm in diameter, from the sample having been prepared in accordance with 3., punch a hole approximately 6 mm in diameter in the center of each specimen, and mount it to the rubber mat of the specimen holder in a Taber type abrasion tester shown in Fig. 17 with the surface of the specimen upwards. Then placing the specified abrasion rollers ([31]) on the specimen, give the specimen rotational abrasions at a rate of approximately 70 turns per minute to make the measurements in accordance with any one of the following methods.

(1) Measurement of Loss in Mass Measure the loss (g) in mass of specimen after subjected to the specified turns ([32]) of abrasion, and express the loss in one place of decimals as average of five measurements.

(2) Measurement of Loss in Thickness Measure the thickness (mm) of specimen after subjected to the specified turns ([32]) of abrasion, and obtain the loss in thickness (%) from the formula below. Express it to one place of decimals as average of five measurements.

$$\text{Loss in thickness } (\%) = \frac{T_c - T_a}{T_c} \times 100$$

where, T_c: original thickness (mm)

T_a: thickness after specified turns of abrasion (mm).

(3) Measurement of Loss in Tensile Strength Prepare a test piece approximately 3 cm in width and approximately 6 cm in length from the specimen after subjected to the specified turns ([32]) of abrasion, and remove the same number of yarns from both sides of the test piece to make into 2.5 cm width to be used for the tensile strength test. Measure the tensile strength (N {kgf}) of the test piece with a clamp distance of 2.5 cm. Calculate the loss (%) in tensile strength from the formula below, and express it in one place of decimals as average five of measurements. The tension speed used shall be noted in the test report.

$$\text{Loss in tensile strength } (\%) = \frac{S_a - S}{S_a} \times 100$$

where, S_a: original tensile strength (N) {kgf}

S: tensile strength after specified turns of abrasion (N) {kgf}.

(4) Evaluation of Change in Appearance Examine the appearance of specimen after subjected to the specified turns ([32]) of abrasion, and evaluate it as follows:

Grade A: No change noticed

Grade B: Slightly damaged

Grade C: Warp or weft yarns broken.

Notes ([31]) Th abrasion r ller given in Tabl 5 shall be used, as a rule.

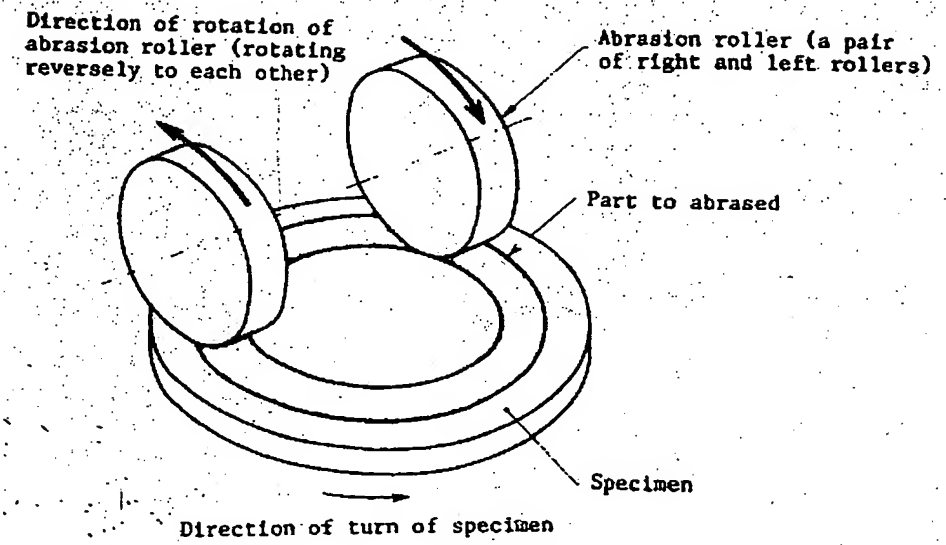
([32]) Th specified turns of abrasion shall be 50, 100, 300 or 500, out of which the number of abrasi n turns suited to the nature of fabric should be selected.

Table 5. Test Conditions

Mass of fabric	Abrasion roller No.	Load N {gf}
180 g/m^2 or under	CS-10	2.45 { 250}
Over 180 g/m^2 up to and incl. 500 g/m^2	CS-10	4.90 { 500}
Over 500 g/m^2	CS-17	9.81 {1000}

Remark: Before the commencement of the test, it is necessary to produce a fresh abrasion surface of the roller. This refreshment shall be made by rotating the roller approximately 15 times on the speicmen holder with an abrasive paper mounted on it.

Fig. 17. Taber Type Abrasion Tester



6.17.4 Method D (Accel rotor Type Method) Take three test specimens, each measuring 11 cm × 11 cm, from the sample having been prepared in accordance with 3., remove the yarns approximately 0.3 cm in width from four sides, and obtain its mass A (g) of each specimen under the standard condition after fixing the yarns on the four sides with a bonding agent. Then fold the specimen as shown in Fig. 19, and insert it under the rotor (11.4 cm in length) of the accelerotor type abrasion tester shown in Fig. 18. After rotating the rotor at a rate of 3000 r.p.m. for 5 min, remove the fiber ravelings deposited on the specimen and between its yarns, and obtain its mass B (g) of specimen under the standard condition. Calculate the loss in mass (%) from the formula below, and express it to one place of decimals as average of three measurements. In this test, the abrasive paper to be attached ot the cylindrical inner wall of the tester shall be that specified in JIS R 6253, and its number and the type of rotor used (S shape or flat) shall be noted in the test report.

$$\text{Loss in mass } (\%) = \frac{A-B}{A} \times 100$$

where, A: mass before abrasion (g)

B: mass after abrasion (g).

Fig. 18. Accelerotor Type Abrasion Tester

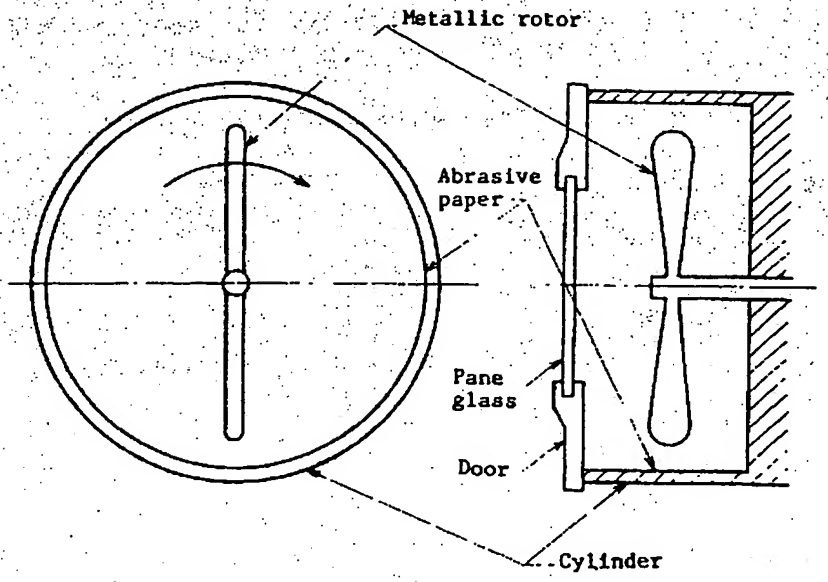
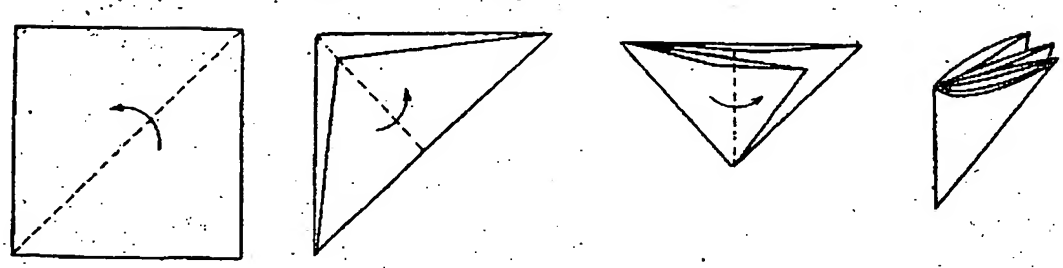


Fig. 19. Preparation of Specimen



6.17.5 Method E (Martindale Method) This method is principally applicable to wool fabrics.

Take four test specimens, ach 3.8 cm in diameter, from the sample having been prepared in accordance with 3., and mount one to the specimen holder ([33]) of a Martindale abrasion tester shown in Fig. 20 on the abrasion tabl of which is previously placed a standard abrasion cloth given in Tabl 7 on a woven felt ([34]). Then put the specimen on the abrasion cloth, apply to it the pressing load given in Table 6 and give it the abrasion in various directions ([35]). Count the times of abrasion needed before the specimen reaches the end point ([36]), and express it in a unit of 100 times as average of four measurements.

Table 6. Test Conditions

Nature of fabric	Pressing load kPa{gf/cm^2}
For clothing	9.0 ± 0.2 { 92 ± 2}
For furniture	12.0 ± 0.3 {123 ± 3}

Table 7. Standard Abrasion Cloth

Item	Warp	Weft
Yarn count	55 tex× 2 (2/36.11)	74 tex× 2 (2/27.0)
Density	19 yarns/cm	12 yarns/cm
Number of twists	S 470±20/Z 490±20/m	S 410±20/Z 550±20/m
Average fiber diameter	31 ± 2 μm	
Mass per unit area in standard condition	185 g/m^2	
Frequency of replacements	1. Replace at each finish of test. 2. For the test of 50000 abrasions or over per one time, replace at every 50000 abrasions.	

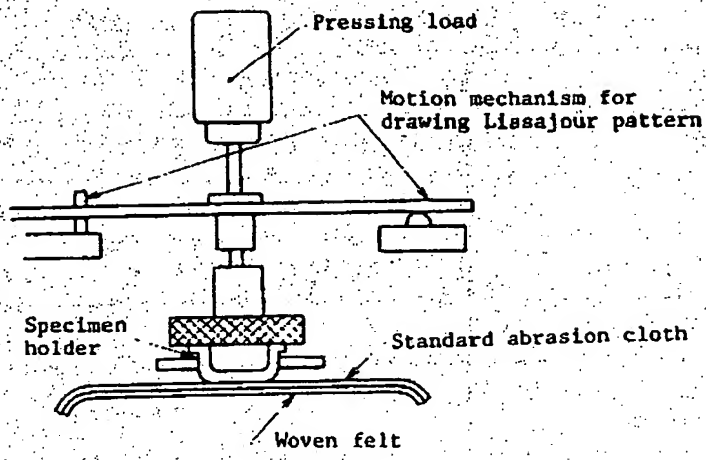
Notes ([33]) Mount the specimen 500 g/m^2 or under in unit mass (excluding laminated cloth) on the speicmen holder after putting a polyurethane sheet (0.04 g/cm^2 in apparent density and approximately 3 mm in thickness) over the backside of the speicmen.

([34]) The woven felt to serve shall be 576 to 678 g/m^2 in unit mass and approximately 1.8 mm in thickness. The woven felt shall be replaced when abrazed, when two surfaces are stained or when a test of 25 abrasions is finished.

([35]) A counter is adjusted to "0", and a reserve set counter is set to a suitable number of times of abrasion (for instance, 5000 times). Then, the machine is started. After reaching the preliminarily set number of times of abrasion, the specimen is examined, thereafter judged at each stop. As drawing nearer to an end point, the number of continuous abrasions is decreased. If wool pills are produced on the specimen during the test, they shall be carefully removed by cutting only the fibers sticking out of the surface of the specimen with sharp scissors or a sharp razor.

([36]) The end point shall be defined as the time when the change in color of the specimen falls under No. 3 on the gray scale for assessing change in color or as the time when two or more yarns located separately in the specimen are severed completely.

Fig. 20. Martindale Abrasion Tester



6.18 Compressibility and Compression Elastic Modulus Take 15 test specimens, each measuring approximately 5 cm × approximately 5 cm, from the sample having been prepared in accordance with 3. Using a compression elasticity tester, measure the thickness (mm) of three piled ([37]) specimens under the initial load of 4.9 kPa {50 gf/cm^2}, and then measure it (mm) again after leaving it still for 1 min under a load of 29.4 kPa {300 gf/cm^2}. Then, remove the load, leave the specimens still for 1 min, and measure the thickness (mm) under the initial load. Obtain the compressibility (%) and compression elastic modulus (%) by the formulas below, and expr ss them to a digit f integer as average of five measurements. The initial load, however, shall be 0.196 kPa {2 gf/cm^2} for raised bulky fabrics and piled wool fabrics.

$$\text{Compressibility } (\%) = \frac{T_0 - T_1}{T_0} \times 100$$

$$\text{Compression elastic modulus } (\%) = \frac{T_0' - T_1}{T_0 - T_1} \times 100$$

wher , T_0: thickness under initial load (mm)

T_1: thickness under final load (mm)

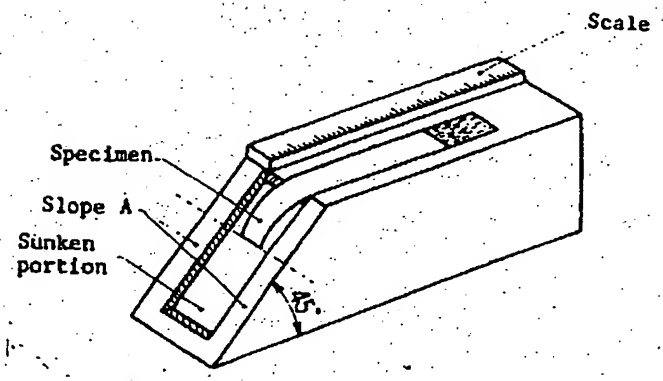
T_0': thickness under load returned to the initial load (mm).

Note ([37]) The thickness of a thick fabric or a wool fabric, either raised or piled, may be measured for a single sheet. The other number of specimens and other load, if used, shall be noted in the test report.

6.19 Stiffness

6.19.1 Method A (45° Cantilever Method) Take five test specimens, each measuring 2 cm × approximately 15 cm, each in the warp and weft directions from the sample having been prepared in accordance with 3. Place the specimen on the horizontal table having 45° slope on one side and a smooth surface as shown in Fig. 21 so as to align the short end of the specimen with the base line of the scale. Then, slide the specimen slowly towards the slope by a suitable means, and read the position (mm) of the other end on the scale when the central point of the one end naturally comes in contact with slope A. The degree of stiffness is indicated by the moving distance of the specimen. The stiffness shall be measured both for the surface and for the back of each specimen. Express the stiffness in a digit of integer as average of the measurements made for the surface and back of five specimens each in the warp and weft directions.

Fig. 21. Cantilever Type Tester



6.19.2 Method B (Slide Method) Take five test specimens, each measuring 2 cm × approximately 15 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. On a tester shown in Fig. 22, slide the movable table so that its upper surface is flush with the upper end of the tester body, and fix the specimen and a weight t · the tester. Allow the weight on the specimen to stick out of the tester body slightly toward the table. Then turn the handle gently to lower the table, and

read the value δ indicated when the free end of the specimen parts from the table surface by the attached scale. Separately measur the mass (g/cm^2) of the specimen per unit area, and obtain the stiffness by the formula below. Measure the stiffness both for surface and for back of each specimen. Express the stiffness ($N \cdot cm$ {$gf \cdot cm$}) to one place of decimals as average of the measurements made for the surface and back of five specimens made each in the warp and weft directions.

$$\text{Stiffness } (N \cdot cm\ \{gf \cdot cm\}) = \frac{WL^3}{8\delta}$$

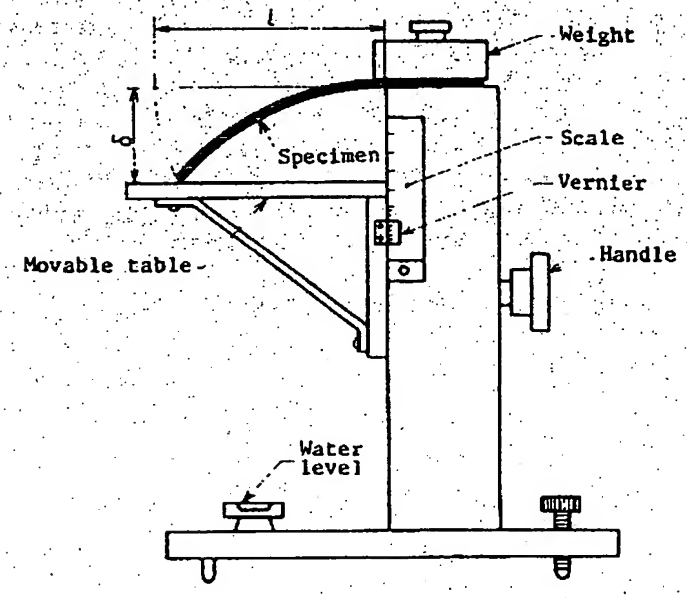
where, W : force of gravity per unit area of specimen (N/cm^2 {gf/cm^2})

L : length of specimen (cm)

δ : deflection of specimen (cm).

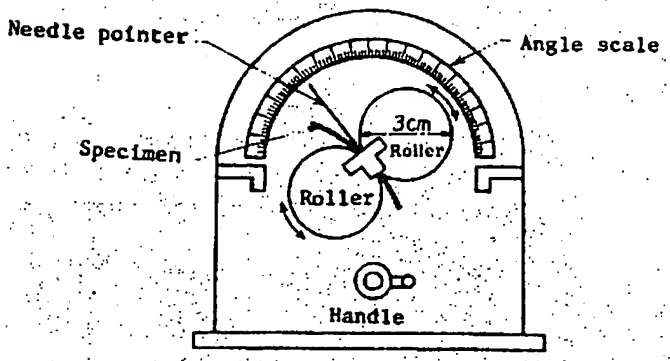
Remark: The stiffness by a slide method is expressed by the bending moment to the unit bend for the unit width of a specimen.

Fig. 22. Slide Type Tester



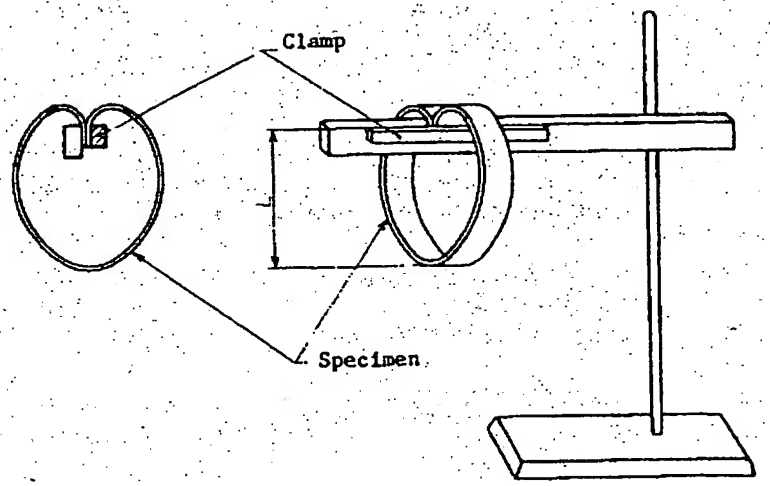
6.19.3 Method C (Clark Method) Take five test specimens, each measuring 2 cm × (15 to 25) cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Using a Clark type tester shown in Fig. 23, hold the specimen between two rollers. Turn the handle right and left to regulate the length of the specimen sticking from the holding position of the rollers so that the sum of the angles of the sp cimen as the sp cimen inclines to the right and to the left is 90 ± 2° as indicated on the angle scal . Then m asure the length (mm) at the time, and express the stiffness to a digit of integer as av rage of five measurements made each in the warp and weft directions.

Fig. 23. Clark Type Tester



6.19.4 Method D (Heart Loop Method) The ten test speicmens, each measuring 2 cm × 25 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Fix the specimen to the clamp of the horizontal bar, as shown in Fig. 24, to a shape of heart loop so that the effective length of the specimen comes to 20 cm. Next, after a lapse of 1 min, measure the distance L (mm) between the top of the horizontal bar and the lowest point of the loop. The stiffness is indicated by the length L. Express the stiffness to a digit of integer as average of the measurements both for the surface and for back of ten specimens made each in the warp and weft directions.

Fig. 24. Fitting of Specimen



6.19.5 Method E (Handleometer Method) Take three test specimens, each measuring 20 cm × 20 cm, from the sample having been prepared in accordance with 3., and place the specimen on the specimen table shown in Fig. 25 so that the direction to be measured of the specimen is at right angles to the slot (20 mm). Lower the blade of the penetrator, which is devised to descend 8 mm below the surface of the specimen, to depress the specimen, and then read the maximum value (g) shown by the micro-ammeter, which is obtained by the measurement of the differ nt points (38) on the surface and back each in the warp and weft directions at th position 6.7 cm (1/3 of the testing width) apart from one of the sides. Obtain the sum of values thus obtained, and express the stiffness to one place of decimals as average of three measurements.

Note ([38]) Measurements shall be made in the order of the serial number given in Fig. 26.

Fig. 25. Test Table

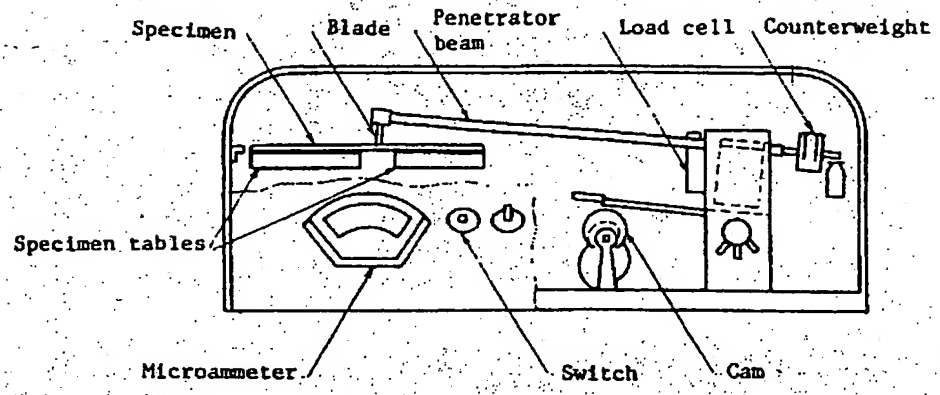
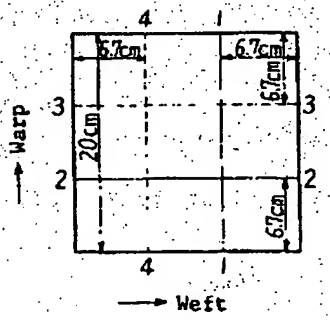


Fig. 26. Measuring Method



Remark: As required by the nature of the specimen, the specimen smaller than 20 cm × 20 cm (but 2.54 cm × 2.54 cm or over) may be used.

The measurement may be made with the slot 5 mm or 10 mm in width. In this case, the testing conditions shall be noted in the test report.

6.19.6 Method F (Handling Tester Method) Take three circular test specimens, each 20 cm in diameter, from the sample having been prepared in accordance with 3. Select a ring by the aid of Table 8 according to the thickness ([39]) of the specimen, and mount it on the tester. On the other hand, attach a metallic ball 0.8 cm in diameter to the center of the back of the specimen, and attach the specimen to the tester from the underside of the ring with care not to allow it to contact the ring.

Then lower the ring at a rate of 30 cm per minute, and obtain the maximum load (N {gf}) (read up to 1/2 of the minimum scale) which is required for the specimen to pass through the ring. Repeat this measurement three times for one sheet of the specimen, and obtain an average. Obtain the passing resistance (N {gf}) by the formula below, and express it to one place of decimals as average of three measurements.

$$\text{Passing resistance } (\text{N}\{\text{gf}\}) = \frac{W}{P}$$

where, W: pressing l ad (N{gf})

$$P: \text{ fullness } = \frac{4 \times D \times L}{d^2}$$

where, D: diameter of specimen (cm)

d: inside diameter of ring (cm)

L: thickness of specimen (mm).

Table 8. Classification of Rings

Thickness of specimen mm	Inside diameter of ring cm
~0.12	1.0
0.13~0.28	1.5
0.29~0.50	2.0
0.51~0.78	2.5
0.79~1.12	3.0
1.13~1.53	3.5
1.54~2.00	4.0

Note ([39]) Measurement of the thickness shall be made in accordance with 6.5.

Remarks 1. When the thickness of the specimen is 2.00 mm or over, a specimen 15 cm in diameter shall be taken, and the test shall be made by the use of a ring which will bring the fullness value to 0.5 to 1.0.

2. When the mass of the specimen affects the measurement, the size shall be 3 cm × 3 cm.

3. For a thin specimen, three specimens may be piled and measured to obtain the thickness per sheet.

6.19.7 Method D (Drape Factor) Take five circular test specimens, each 25.4 cm in diameter, from the sample having been prepared in accordance with 3., and punch a hole approximately 1 cm in diameter in the center of each specimen. Place the specimen on the specimen holder 12.7 cm in diameter for the drape tester shown in Fig. 27 with its surface facing upwards, and leave it still for 1 min after vibrating it vertically three times. Then measure the area of the drape shape formed at that time for the surface and back of the specimen. Obtain the drape factor by the formula below, and express it to three places of decimals as average for the surface and back of the specimen.

$$\text{Drape factor} = \frac{A_s - S}{S_s - S}$$

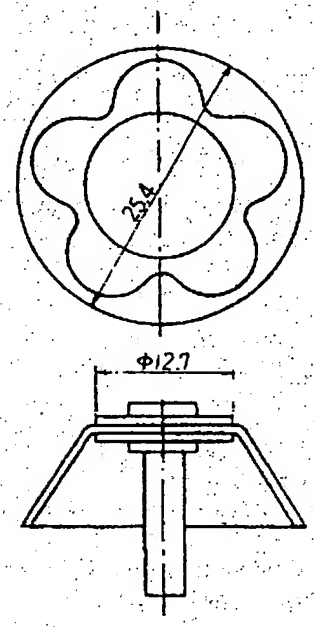
where, A_d: vertically projected area of specimen (i.e. area of drape shape) (mm^2)

S_1: area of specimen holder (mm^2)

S_2: area of specimen (mm^2).

Fig. 27. Drape Tester

Unit: cm



6.20 Bending Repulsion

6.20.1 Method A (Gurley Method) Take five test specimens, each measuring L cm in length and d cm in width, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Using a Gurley type tester shown in Figs. 28 and 29, mount the specimen to the chuck, and fix the chuck to the movable arm adjusting it to the scale $L/2.54$ on the arm. Next, respectively mount each of the suitable weights W_a (g), W_b (g) and W_c (g) to each of the weight setting holes a, b and c located below the fulcrum of the pendulum B, and rotate the movable arm at a fixed rate. Read the scale RG when the specimen parts from the pendulum B. Obtain the stiffness, by which is meant how much the specimen has the bending repulsion, by the formula below. Measure it for the surface and back of five specimens, and express it to one place of decimals as average each in the warp and weft directions.

$$\text{Stiffness (mgf)} = RG \times (aW_a + bW_b - cW_c) \times \frac{L^3}{d} \times 0.306$$

where, a, b, c: distances between weight setting hole and fulcrum (cm).

Fig. 28. Gurley Type Tester

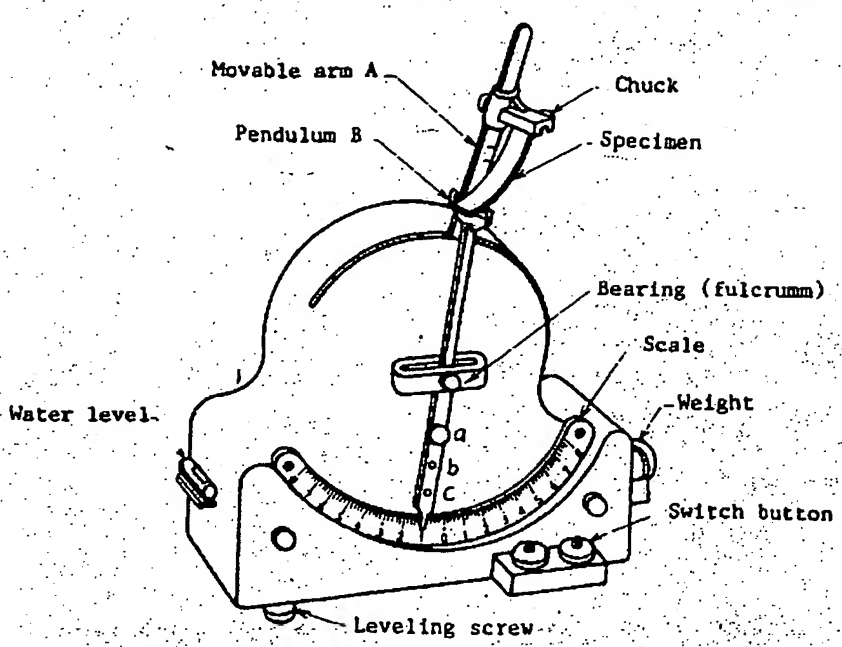
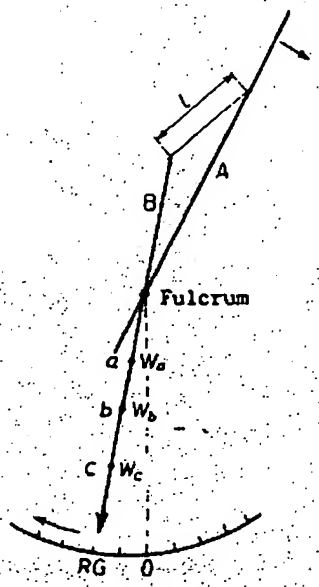


Fig. 29. Principal Pasrts of Gurley Type Tester



6.20.2 Method B (Bending Method) Take ten test specimens, each measuring 2.5 cm × 5 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Using an Orsen type tester as shown in Fig. 30, measure the state of the specimen when it is bent through the specified displacement angle ([40]). Obtain the bending repulsion (N · cm {gf · cm}) by the formula below, and express it to one place of decimals each in the warp and weft directions as average of ten measurements.

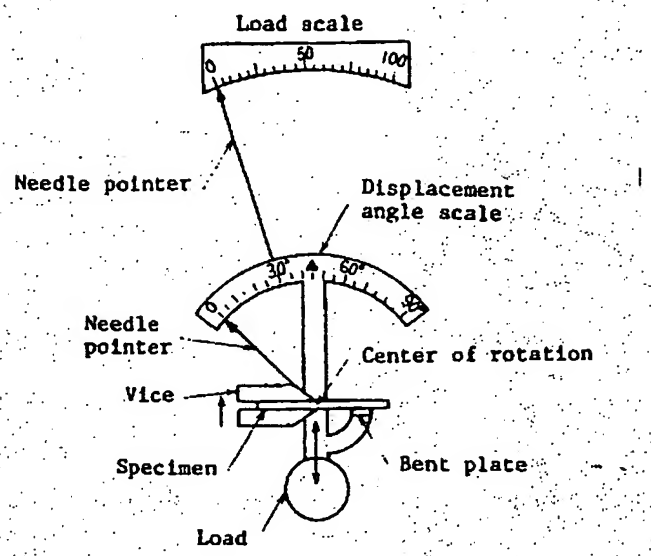
$$\text{Bending repulsion } \{\text{N·cm } \{\text{gf·cm}\}\} = \frac{W \times M}{100}$$

where, W : load (gf) {N}

M : reading of load scale (cm).

Note ([40]) The displacement angle shall be 30° or 60°, as a rule.

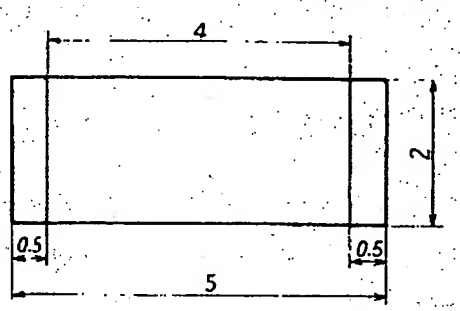
Fig. 30. Principal Parts of Orsen Type Tester



6.20.3 Method C (Loop Compression Method) Take five test specimens, each measuring 5 cm × 2 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3., and put a mark in the position 0.5 cm apart from each end of a specimen at an interval of 4 cm, as shown in Fig. 31.

Fig. 31. Dimensions of Specimen

Unit: cm



Mount a device for loop compression as shown in Fig. 32 on a tension tester with autographic recorder, and set the tester for the following conditions:

(1) Head speed : 50 mm/min

(2) Chart speed : 500 mm/min

(3) L_1 : 20 mm

(4) L_2 : 5 mm

Clamp the specimen in the portion 0.5 cm from each end in the clamps, and put it on the compr ssion load cell so that the center line of the pr ssing element (see Fig. 33) coincides with the center line of the specimen. Then raise the specim n from the position L_1 (20 mm), as shown in Fig. 32 (a),

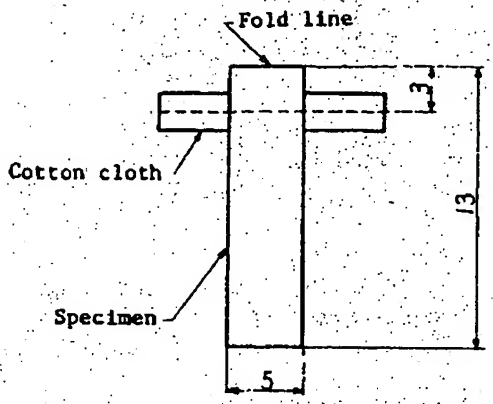
Notes ([41]) The specimen shall be sewn tog ther with a cotton cloth, measuring 2 cm in width × 15 cm in length, specified in JIS L 0803, inserted between the fold d portions as shwon in Fig. 35, in order to prevent the sewing threads from being drawn inward by the tester at the start and the end of sewing.

([42]) If the specimen breaks down under a load less than 147.1 N {15 kgf}, the load (N {kgf}) shall be reduced to 2/3 of the breaking load, and the load applied shall be noted in the test report.

([43]) The warp direction slippage means the slippage of a weft yarn over a warp yarn and the weft direction slippage means the slippage of the warp yarn over the weft yarn.

Fig. 35. Preparation of Specimen

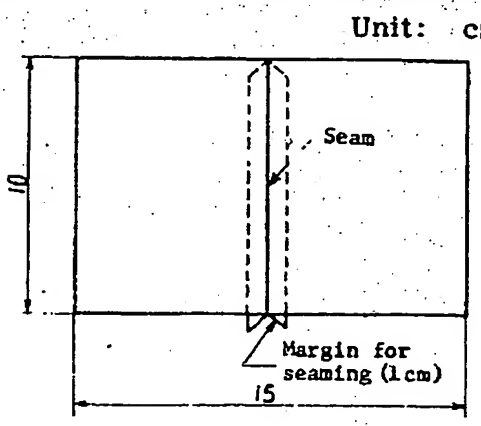
Unit: cm



(2) Method B Take five specimens, each measuring 10 × 17 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. ([39]). Fold it at the center of its length with its inside out, cut the fold, and sew together the portions 1 cm apart from the cut end ([44]), as shown in Fig. 36 under the same conditions as described in Method A.

Fig. 36. Preparation of Specimen

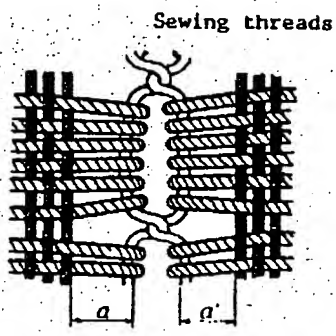
Unit: cm



Using a tension tester, pull the specimen with a clamping distanc of 7.62 cm at a tension speed of 30 cm per minute under the specified load ([45]), as specified in Grabb Method, and take off the specimen from the clamps. After leaving it still for 1 hour, apply a load (approximately 4.90 to 9.81 N/2.54 cm {approximately 0.5 to 1.0 kgf/2.54 cm}) enough to remove a slackening around the seam perpendicularly to the seam, and measure the size of the largest hole of the seam slip to the nearest 0.1 mm. Express the largest size of the seam slip hole to one place of decimals as average of five measurements each in the warp direction and the weft direction.

Take the value ($a+a'$) shown in Fig. 37 as the size of the seam slip.

Fig. 37



Notes ([44]) To suit the use or the purpose of a fabric, the sewing conditions may be altered appropriately, with the alteration noted in the test report.

([45]) The load shall be 49.0 N {5 kgf} for a thin fabric such as that for blouse, and 117.7 N {12 kgf} for a thick fabric such as that for slacks. The values may be altered, if the use or the purpose of a fabric so requires, with the alteration noted in the test report.

(3) Method C Take five test specimens, each measuring 10.1 cm × 35.0 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Fold each specimen in parallel with the warp or weft direction in the lengthwise direction so that the length from the fold to one end is approximately 10 cm.

Sew a portion 1.3 cm apart from the fold and parallel with it ([46]) at a rate of 14 stitches per 2.54 cm with No. 60 mercerized white cotton yarn specified in JIS L 2101 by the use of # 11 needle, and then cut the fold. Prepare the specimen A with the seam at right angles to the weft direction and the specimen B with the seam at right angles to the warp direction.

Following the Grabb Method specified in Method B of 6.12.1. use a tension tester with autographic recorder. Clamp the specimen so that the end of the specimen near the seam is held by the upper clamps and so that the seam is positi ned in the middle b tween the clamps, with the clamping distance of 7.6 cm under the initial load ([47]) of 1.67 N {170 gf}. Allow the tester to draw a load-elongation curve.

Separately, hold the specimen so that the end opposite the seam is positioned at the upper clamps ([48]), and obtain a load-elongation curve of seamless portion.

Superpose these two load-elongation curves so that they are contained in the same coordinates and also they are originated at the same origin, as shown in Fig. 38, and use the distance between these curves indicated under the load of 4.90 N {0.5 kgf} as the correction value. Obtain the difference in elongation by adding the distance corresponding to a slip of 0.6 cm to the correction value on the same vertical coordinate of the two curves. A value obtained by subtracting the load of 4.90 N {0.5 kgf} for obtaining the correction value from the load (N {kgf}) obtained from the foot D of the vertical coordiante shall be considered the resistance which the 6-mm slippage requires per 2.54-cm width. Express the slippage resistance to one place of decimals as average of five measurements made each for the warp and weft yarns ([43]). The resistance in an optional slippage shall be obtained in the way mentioned above, as appropriate.

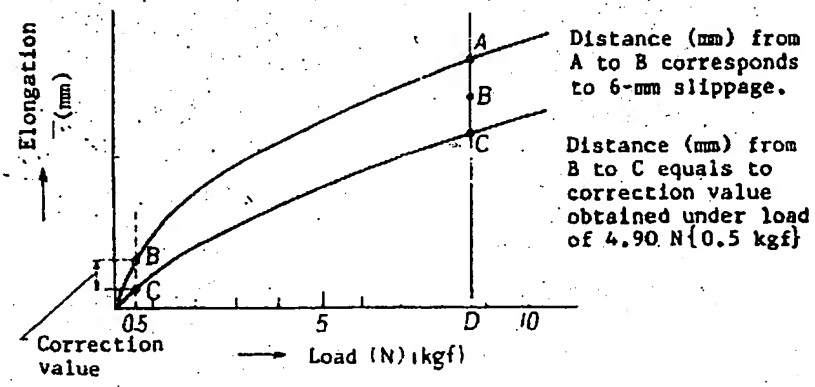
Notes ([46]) The sewing shall be made by lock stitching, and the threads, both upper and lower, shall be regulated to maintain a uniform tension.

([47]) For the initial load, a weight of 6.17 N {17.0 gf} with the clamp 10.1 cm in width shall be employed.

([48]) Clamp the yarns woven in the same direction as the specimen used for obtaining the load-elongation curve of the seam.

Remark: This method applies to the thin filament fabric.

Fig. 38. Load-elongation Curve



(4) Method D This m thod applies principally to the wool fabrics.

Take three test specimens, each measuring 17.5 cm × 10.5 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3., and remove approximately the same number of yarns from both long sides to a width of 10 cm. Fold each specimen in the middle of its length with the surface out, sew it together under the following conditions at a position 1.3 cm apart from the folded end, and then cut the fold (see Fig. 39).

(a) Sewing Machine Electrically driven sewing machine with single needle for lock stitching, capable of sewing at a rate of 700 to 1000 stitches per minute.

(b) Number of Stitches 14 stitches/2.54 cm

(c) Type of sewing needle and sewing thread As specified in Table 9.

Table 9. Types of Sewing Needle and Sewing Thread

Mass of fabric	Diameter of sewing needle mm	Sewing thread
140 g/m² or under	0.75	60/3^{s} mercerized cotton yarn for sewing machine
140 g/m² or over	0.90	36/3^{s} mercerized cotton yarn for sewing machine

Using a tension tester with clamps, one 2.5 cm length × 2.5 cm width in size and the other 2.5 cm length × 4 cm or over width, stretch the specimen with a clamping distance of 7.5 cm at a tension speed of 5 cm per minute until the load reaches the value specified in Table 10. At that time, measure the distance between both sides showing the largest open seam at right angles to the seam line (see Fig. 40).

Table 10

Nature of fabric	Load to be applied N {kgf}
Clothing use fabric 140 g/m² or under in mass	78.45 { 8}
Clothing use fabric exceeding 140 g/m² in mass	117.68 {12}
Furniture use fabric	176.52 {18}

Fig. 39. Specimen

Unit: cm

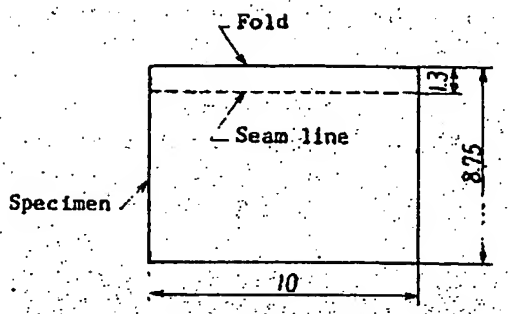
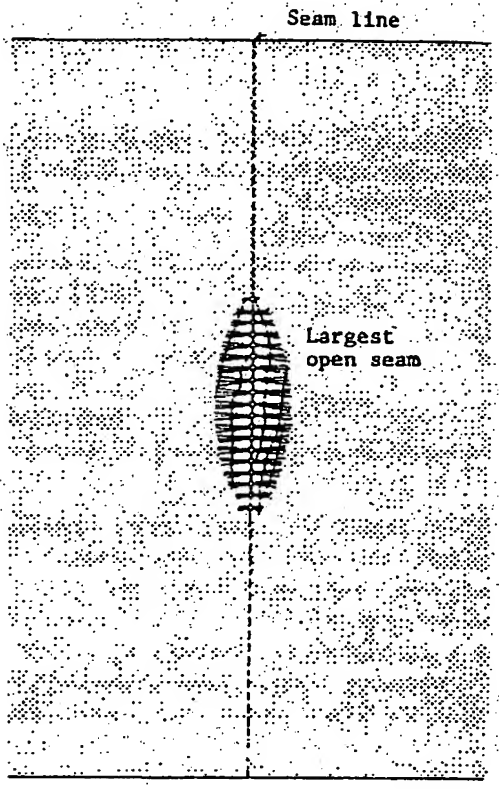


Fig. 40. Largest Open Seam



6.21.2 Thread Drawing-out Method The thread drawing-out method shall follow the method (1) or (2) described below.

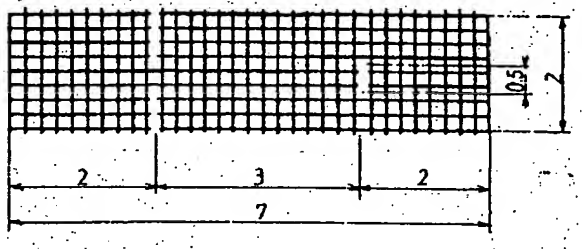
(1) Method A Take five test specimens, each measuring 2 cm × 7 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Mark each specimen at a position 2 cm apart from the end and at a position 3 cm further apart from the position mentioned above, along its long side, both at right angles to the long side. Then, as shown in Fig. 41, give a cut 0.5 cm in width at one of the two marks in the middle of the short side at right angles to the long side and, at the other mark, cut off all the yarns leaving only two yarns in the middle part of the short side.

Mount the specim n on the tension t ster with a clamping distance of 3 cm, and measure the largest drawing-out r sistance (N {gf}). Express the largest drawing-out resistance to a digit of integer as average of five measurements made each in the warp and weft directions.

The type of the tension tester used and tension speed or loading rate applied shall be noted in the test report.

Fig. 41

Unit: cm



Remarks 1. This method is to check the degree of the broken weave in a fabric.

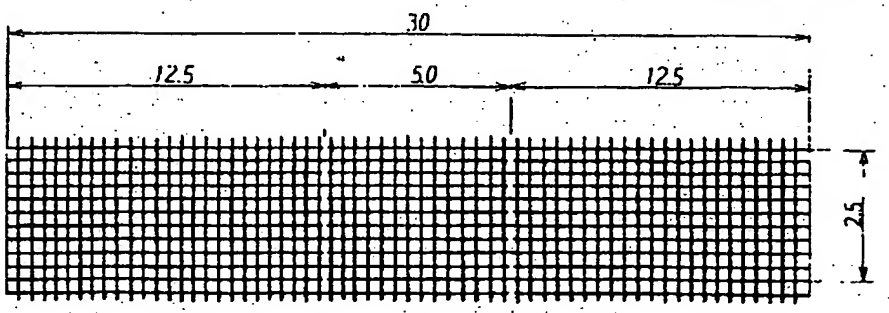
2. The largest drawing-out resistance may be gauged by the use of a strain meter.

(2) Method B Take three test specimens, each measuring 3 cm × 30cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Remove the same number of yarns from both sides to obtain a specimen measuring 2.5 cm × 30.0 cm. As shown in Fig. 42, insert a needle into the specimen at the position approximately 12.5 cm apart from the end at right angles to the long side, cut the yarns of odd numbers, insert a needle similarly into the specimen at the position 5.0 cm apart from the position mentioned above toward the opposite end, and cut the yarns of even numbers.

Using a tension tester, stretch the specimen in the same way as in 6.12.1 to allow the yarns to slip from each other. Measure the largest drawing-out resistance (N {kgf}), and express it to one place of decimals as average of three measurements made each in the warp and weft directions.

Fig. 42

Unit: cm



6.21.3 Hook Pin Method Take three test specimens, each measuring 5 cm × approximately 15 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. As shown in Fig. 43, remove the yarns of the short side in the range (*b*) of 0.5 cm from the position (*a*) which is 0.5 cm apart from one end along the long side. Insert the pins shown in Fig. 44 into the portion where the yarns have been removed as above, and mount the specimen on a fabric tension tester. Stretch the part (*c*) at a tensile speed of 15 or 20 cm per minute by the method described in 6.12.1, and measure the largest drawing-out resistance (N {kgf}) of the part (*a*). Express the largest drawing-out resistance to one place of decimals as average of three measurements made each in the warp and weft directions.

Fig. 43

Unit: cm

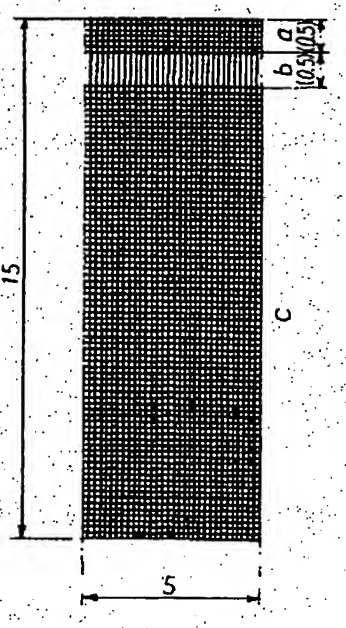
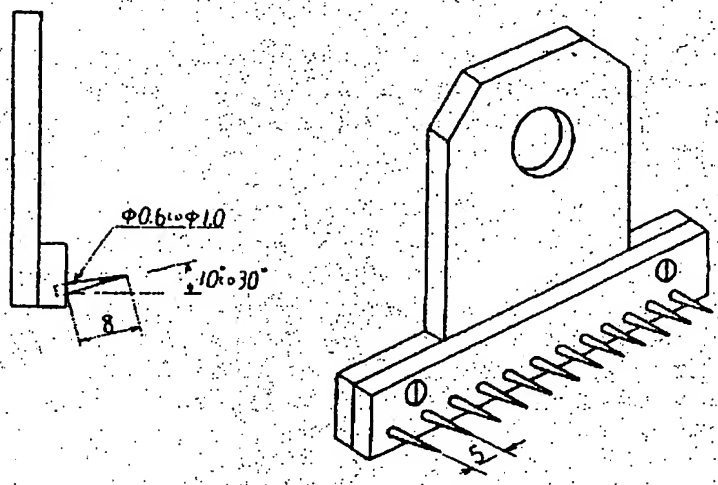


Fig. 44

Unit: mm



6.22 Wrinkle Recovery The wrinkle recovery shall be as specified in JIS L 1059.

6.23 Wrinkles after Laundering

6.23.1 Method A (Method Using Stirrer Type Washing Machine) Take three test specimens, each measuring 40 cm × 40 cm, in parallel with each other, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Hem the specimen to avoid raveling, if required, and put a mark in the warp direction.

Fill the washing machine ([49]) with water of approximately 40°C ([50]) to the water level of the tank, add synthetic detergent for home laundering specified in JIS K 3371 at the rate of 1 g/ℓ, and agitate the water thoroughly to allow the detergent to solve. Add a suitable number of sheets of dummy cloth ([51]) to the three specimens to obtain a liquor ratio of 40 : 1 in the laundering liquid, and set the machine laundering automatically ([52]).

The temperature of water to be used for rinsing shall be approximately 40°C ([53]).

After laundering, dry the specimens by any one method of the following:

(a) Drip Drying ([54]) Clamp a specimen at several positions without dehydration so that its warp direction is vertical, and suspend it to dry in a windless place at room temperature.

(b) Line Drying After dehydration, clamp a specimen at several positions so that its warp direction is vertical, and suspend it to dry in a windless place at room temperature.

(c) Tumble Drying Immediately after dehydration, take out the specimens togetehr with the dummy sheets, untie the tangled pieces, put into the tumble drier ([55]), and dry at a temperature of 60 to 70°C for approximately half an hour. Cease heating, continue running the drier for approximately 5 min, and cool down. The instant the machine stops, take out the specimens.

Repeat the cycle of these washings and dryings five times and leave still the specimens through with the final drying, clamped in several positions and with the warp direction vertical, in a room under the standard condition for 2 h or more.

Mount the specimen thus obtained on the viewing board ([57]) of viewing apparatus ([56]) installed in a darkened room, with the specimen length in the vertical direciton. Place the standard replicas for assigning ratings on both sides of the specimen. Three trained observers should rate each specimen independently. An observer is to stand directly in front of the specimen approximately 122 cm away from the board to rate the appearance of the specimen in contrast to the standard replicas in accordance with the rating criteria given in Table 11.

Similarly, the observer should independently rate each of the other three specimens.

The other two observers shall proceed to assign the ratings independently in the same manner.

Table 11. Criteria for Rating Apparent Wrinkles

Rating No.	Criteria
5	Equivalent to DP-5 standard replica
4	Equivalent to DP-4 standard replica
3.5	Equivalent to DP-3.5 standard replica
3	Equivalent to DP-3 standard replica
2	Equivalent to DP-2 standard replica
1	Equivalent or inferior to DP-1 standard replica

Express the apparent wrinkles after laundering to one place of decimals as average of nine ratings judged by three observers for three specimens.

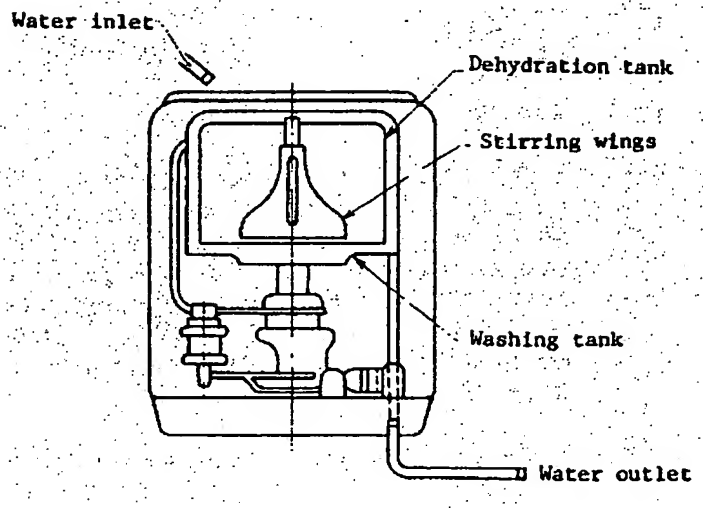
Note th type of test method and the drying method in the test report.

Notes (49) The washing machine to serve shall be of a stirring type equipped with a built-in dehydration d vice and shall display the following performances. Other mchines equivalent t it may be used.

Water capacity:	40 to 70 l
Revolution of stirring wing:	65 to 90 r.p.m.
Revolution angle of stirring wing:	180 to 240°
Revolution of dehydration tank:	500 to 720 r.p.m.
(Revolution of final centrifugal dehydration)	
Inside diameter:	40 to 55 cm

Example: A typical example of the washing machine is shown in Fig. 45.

Fig. 45



(50) If necessary, temperatures 50°C or 60°C may be used with a note in the test report.

(51) The dummy cloth shall be hemmed white cotton shirting (No. 3 Kanakin) approximately 90 cm × 90 cm in size; desired, scoured, hydrogen peroxide bleached, and finished without sizing. The gray fabric to be used for the dummy shall be as specified in Table 12.

Tabl 12. Structure of Dummy Cloth

Yarn to be used	Yarn count		Density (Yarns/5 cm) (For reference)	
	Warp yarn	Weft yarn	Warp yarn	Weft yarn
Cotton yarn	20 tex (30 S)	16 tex (36 S)	141	135

Notes ([52]) The standard sequence of automatic washing operations shall be as follows, though subject to some divergence according to the type of washing machine used.

Washing for 12 min → drainage for 2 min → centrifugal dehydration and spraying for 2 min → water feeding for 3 to 5 min → rinsing for 2 min → drainage for 2 min → centrifugal dehydration and spraying for 2 min → centrifugal dehydration for 4 min.

([53]) If necessary, water of normal temperature may be used with a note in the test report.

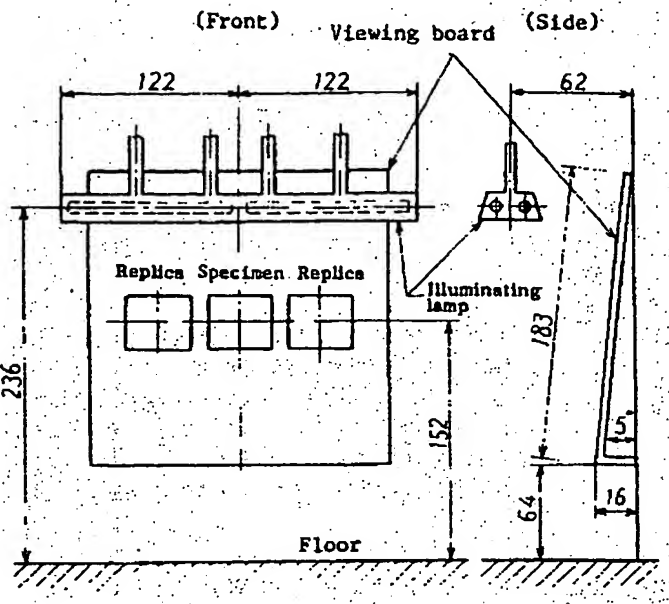
([54]) The drip drying is used for wash and wear fabrics.

([55]) This shall be the drier equipped with three ledges at an interval of 120° in a rotary drum approximately 66 cm in diameter and approximately 46 cm in depth, and capable of rotating at a rate of approximately 50/min and of drying at a controlled temperature in the range from 40 to 70°C. Other driers equivalent or superior to the above-mentioned drier in performance may be used.

([56]) Use the apparatus illustrated in Fig. 46.

Fig 46. Observation Apparatus

Unit: mm



For illumination, four lamps of FL 40 W specified in JIS C 7601 shall be used, and the inside surface of the reflection plate shall be painted white, and the intensity of illumination should preferably be always constant.

Two lamps of FL 40 W specified in JIS C 7601 may be used, provided that, in this case, the replicas identified as DP-1, DP-3 and DP-4 shall always be placed on the left side as they face the viewing board, and the replicas identified as DP-2, DP-3.5 and DP-5 shall always be likewise placed on the right side.

([57]) The surface of the viewing board shall be of the same color as the b_2 chip of rating No. 2 on the gray scale for staining specified in JIS L 0805.

Informative Reference: As judging criteria, there is six-stage three-dimensional replica or the like specified in AATCC Test Method 124-1984 (Appearance of Durable Press Fabrics after Repeated Home Launderings).

6.23.2 Method B (Method Using Cylindrical Type Washing Machine) Use the same test specimens as those for Method A specified in 6.23.1 in this test.

Put water of approximately 40°C of a quantity (approximately 60 *l*) sufficient to submerge the specimens in the washing machine ([58]), add the synthetic detergent for home laundering specified in JIS K 3371 at a rate of 1 g/*l*, and stir thoroughly to allow the detergent to solve.

Throw three specimens and some sheets of dummy cloth ([51]) into the machine to obtain th load of 13.7 N{1.4 kgf}, and set the machine running. After a lapse of 15 min, stop the machine to replace water with fresh water of approximately 40°C. After 5-min rinsing, stop running to replace water again with fresh water of approximately 40°C, and continue to rinse for 10 min.

Then carry out tumble drying in the same manner as specified in (c) of Method A in 6.23.1.

Repeat five cycles of washing and drying, and then perform the ratings of apparent wrinkles after laundering by the same method as Method A of 6.23.1.

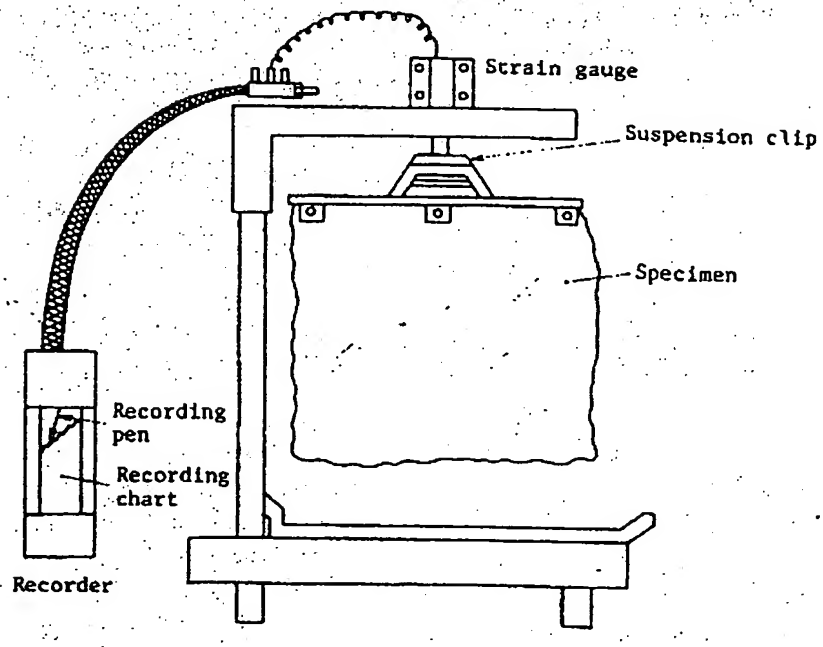
Note ([58]) This shall have a perforated cylinder 50 to 61 cm in width and 45 to 61 cm in inside diameter, equipped, in itself, with three ledges each 7.5 cm in height, at an interval of 120°. It shall rotate at a peripheral speed of approximately 54 m/min, when loaded, and shall reverse itself at every 5 to 10 turns.

6.24 Pleat Retention The pleat retention shall be as specified in JIS L 1060.

6.25 Drying Property

6.25.1 Method A Take three test specimens, each measuring 40 cm × 40 cm, from the sample having been prepared in accordance with 3. Immerse and stretch the specimen in water of 20 ± 2°C to allow it to absorb water fully, and take it out of water. When water no longer drops from the specimen, set it on a drying time measuring apparatus shown in Fig. 47, and measure the time (min) required before the specimen comes to dryness naturally in a testing room under the standard conditions. Express the required time to a digit of integer as average of three measurements.

Fig. 47. Drying Time Measuring Apparatus



6.25.2 Method B Take two test speicmens of the shape shown in Fig. 48, each measuring 202.5 cm^2 in area, from the sample having been prepared in accordance with 3., and weigh the specimen (W_0) with a balance shown in Fig. 49. Then submerge and str tch the specimen in water of 20 ± 2°C to allow it to fully absorb water (for 3 h or more), take it out of water, weigh its mass W (g) 10 min later, obtain the quantity of evaporative free moisture (g/202.5 cm^2) by the formula below, and express it to two places of decimals as average of two measurements.

$$\text{Quantity of moisture } (g/202.5\,cm^2) = W - W_0$$

where, W : mass of specimen weighed 10 min after taken out of water (g)

W_0 : mass of specimen before absorption of water (g).

Remarks 1. The balance shall have the weighing capacity of 10 g and sensitivity of 10 to 20 mg.

2. Care shall be taken not to give an unnatural vibration to the specimen during the time from taking out of water to suspending.

3. If it is found that the difference in moisture is 0.2 g or over in the results of two measurements, another measurement shall be performed, and the quantity of moisture shall be expressed as average of three measurements.

Fig. 48. Dimensions of Specimen

Unit: mm

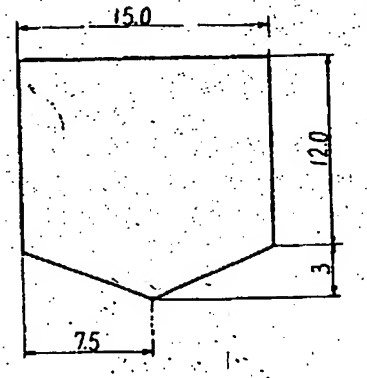
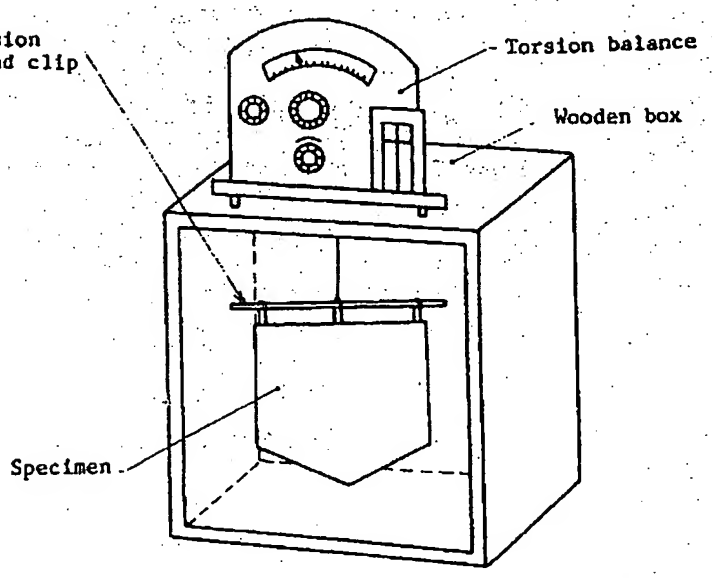


Fig. 49. Balance



6.26 Water Absorbing Property

6.26.1 Water Absorption Speed

(1) Method A (Drop Method) Take ten test specimens, each measuring approximately 20 cm × 20 cm, from the sample having been prepared in accordance with 3., and fix a specimen to a metallic ring 15 cm in diameter. Using a burette capable of delivering 25 ± 3 drops per 1 ml of water ([59]), drip one drop of water from the tip of the burette positioned 1 cm above the surface of the specimen, and measure with a stopwatch the time (in second) required by the drop from reaching the specimen until it ceases a special reflection ([60]). Carry out this measurement ten times, and express the time (in second) to one place of decimals as average of ten measurements.

Notes ([59]) The water specified in JIS K 0050 shall be used. The temperature of water shall be 20 ± 2°C.

If a specimen has a high water-absorbing property, water containing 50 % or 65 % of sugar may substitute for distilled water. In this case, the correction factors 0.141 and 0.023 shall be adopted for 50 % sugar water and 65 % sugar water, respectively.

([60]) The phrase "ceases a special reflection" means a state where a specular surface reflection disappears as the specimen absorbs the watersdrop and only a wet condition remains on the specimen.

The ring to which a specimen is attached shall be placed between the light source and the observer, and the specimen shall be viewed from an angle ensuring a clean observation of the special reflection of the waterdrop.

Remark: The shorter the average wetting time is, the more is the specimen proved to be wettable.

(2) Method B (Byreck Method) Take five test specimens, each measuring 20 cm × 2.5 cm, each in the warp and weft directions, from the sample having been prepared in accordance with 3. Fix the specimens with pins to a horizontal bar which is suspended at a given height above the water basin containing water of 20 ± 2°C. Align the lower ends of the specimens in a line, and lower the bar so that the lower ends of the specimens just steep in water. Suspending steel scales side by side with the specimens from the bar, measure ([61]) the height in mm of water head gained due to capillarity during the period of 10 min. Repeat this test five times each in the warp and weft directions, and express the height in mm to a digit of integer as average of five measurements.

Note ([61]) If it is found difficult to read the height of water head which has risen due to capillarity, it is advisable to spray water-soluble dyestuff such as eosin onto the specimen with a camel hair brush.

Remark: The larger the value is, the higher is the water absorbing property.

(3) Method C (Sinking Method) Take thr e test specimens, each measuring 1 cm × 1 cm, from the sample having been prepar d in accordance with 3. Allow the specimen to float in the basin containing water of 20 ± 2°C, and measure the time ([62]) in second r quired for the specimen to b gin to sink into water du to the water absorption of the specim n. Repeat this test three times, and express the required time t a digit of integer as average of three measurements.

Note ([61]) If sinking requires 3 h or over, the specimen shall be regarded as unsinkable.

6.26.2 Water Absorption Take three test specimens, each measuring 7.5 cm × 7.5 cm, from the sample having been prepared in accordance with 3., and weigh each specimen to 5 mg. Attach a weight ([63]) to one end of the specimen, as shown in Fig. 50, and drop it into a steeping basin containing water of 27 ± 1°C, and after a submersion of 20 min, take it out of the basin. Place the specimen between two sheets of dry filter paper ([64]), let it pass through the roller squeezer ([65]) at the surface speed of 2.5 cm/s, and immediately weigh the mass (mg) of the speicmen to 5 mg. Obtain the water absorption by the formula below, and express it to one place of decimals as average of three measurements.

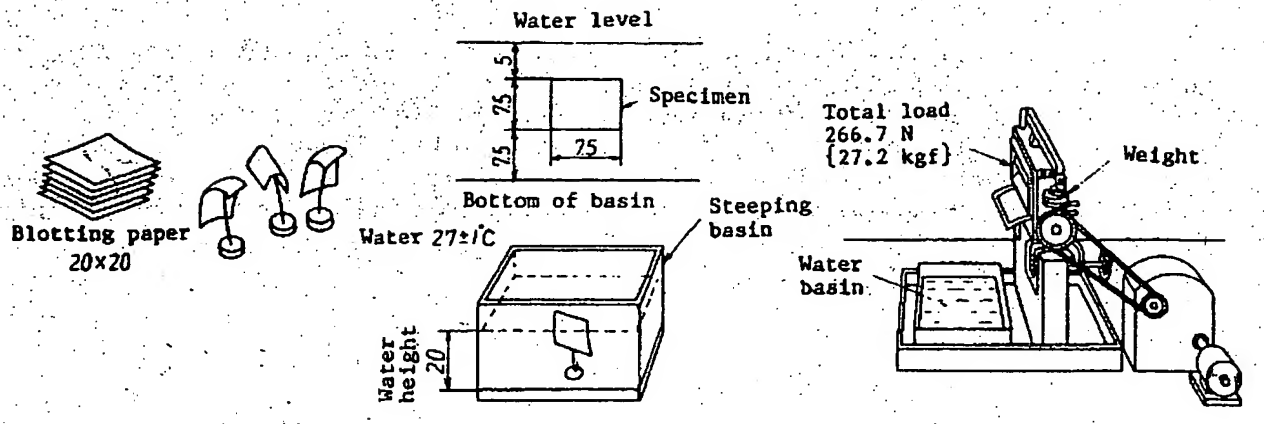
$$\text{Water absorption } (\%) = \frac{W_1 - W}{W} \times 100$$

where, W: mass of specimen before absorbing water (g)

W_1: mass of specimen after absorbing water (g).

Fig. 50. Water Absorption Tester

Unit: cm



Notes ([63]) The weight shall be heavy enough to sink to the bottom of the steeping basin. The water level shall be so adjusted that the upper end of the specimen comes to 5 cm below the water level.

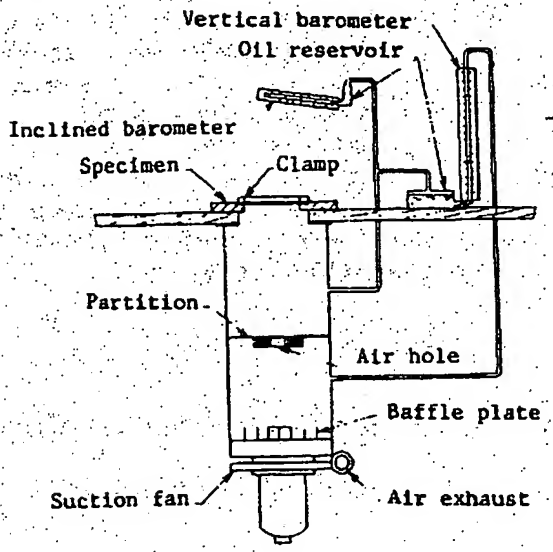
([64]) The filter paper to serve shall be Class 2 square type (20 cm × 20 cm) specified in JIS P 3801.

([65]) The rollers of the squeezer shall be kept under a uniform overall load of 266.7 N{27.2 kgf}, and shall be 30 cm in length and 5 to 6.5 cm in diameter.

6.27 Air Permeability

6.27.1 Method A Using a Frazir type tester shown in Fig. 51, attach the specimen to one end of the cylinder, and adjust the suction fan with the rheostat so that the inclined barometer shows a pressure of 1.27 cm on water column. Obtain the air volume ($cm^3/cm^2 \cdot s$) having passed through the specimen from the pressure indicated at the time by the vertical barometer and from the type of air hole used by the aid of the table attached to this tester. Measure the air volume, and express it to one place of decimals as average of five measurements.

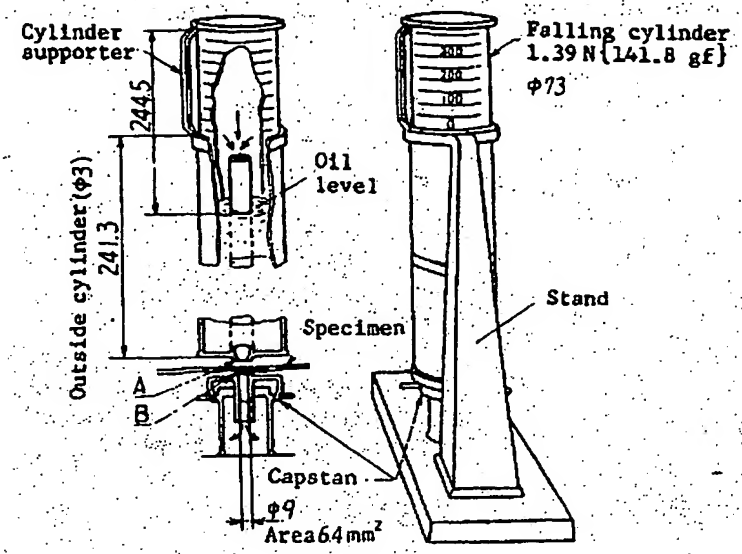
Fig. 51. Frazir Type Tester



6.27.2 Method B This method applies mainly to wool fabrics.

Take five test specimens, each measuring 5 cm × 5 cm, from five different places of a sample, insert a specimen in the air spouting orifice (9 mm in diameter) of an air permeability tester shown in Fig. 52, and fasten it. Measure the time required for 300 ml of air to spout through the specimen under the pressure of 1.39 N {141.8 gf}, and represent the air permeability by the use of the required time. Test three different places of each specimen, and express the required time to one place of decimals as average of the measurements made for five specimens.

Fig. 52 Unit: mm



Twist up the capstan to fasten the specimen with faces A and . Each caliber of A and B is 9 mm.

6.28 Warmth Keeping Property

6.28.1 Method A (Thermostatic Method) Using a warmth keeping tester, attach a sample to a thermostatic heat-generating element. Two hours after the calorific outflow toward the low temperature atmosphere stabilizes and the surface temperature of the heat-generating element shows a fixed value, obtain the heat loss dispersing through the specimen. Separately obtain the heat loss of the thermostatic heat-generating element with no specimen attached under the similar temperature difference and the same duration of time. Obtain the warmth keeping property (%) to one palce of decimals from the two heat losses mentioned above by the formula below. Note in the test report such testing conditions as the difference in temperature between the atmosphere and the surface of heat-generating element, and velocity and direction of airflow (to one place of decimals).

$$\text{Warmth keeping property } (\%) = \left(1 - \frac{b}{a}\right) \times 100$$

where, a: calorie radiated from bare heat-generating element [J/cm²·s] {cal/cm²·s or W/cm²}

b: calorie radiated from heat generating-element to which specimen is attached [J/cm²·s {cal/cm²·s or W/cm²}.

6.28.2 Method B (Cooling Method) Cover the heat source element of a warmth keeping tester with a sample, and cool it down in airflow of low temperature. Measure the difference in temperature of the heat source element which is cooled in a fixed tim or the difference in time required for the element to cool from a fixed temperature to the specified temperature.

Compare the temperature difference or the time difference with that obtained from the bare heat-generating element. Obtain the warmth keeping property (%) to one place of decimals by the formula below. Note the test conditions in the test report.

(1) When Using Temperature Difference

$$\text{Warmth keeping property } (\%) = \left(1 - \frac{b}{a}\right) \times 100$$

where, a: temperature difference in the case where bare heat-generating element cools in a fixed time (°C)

b: temperature difference in the case where heat-generating element covered with specimen cools in a fixed time (°C).

(2) When Using Time Difference

$$\text{Warmth keeping property } (\%) = \left(1 - \frac{a}{b}\right) \times 100$$

where, a: time required for bare heat source element to cool from a fixed temperature to specified temperature (min)

b: time required for heat source element covered with specimen to cool as above (min).

6.29 Light Resistance Take the required number of the test specimens of the required size from the sample having been prepared in accordance with 3. Using a fading tester, expose the specimens to the test light for a specified period of time, take them out, and condition them into the standard conditions. For the specimens thus conditioned, carry out the tests on tensile strength, waterproofness, change in color, etc., as required.

For example, the tensile strength retention rate can be obtained by the formula below.

$$\text{Tensile strength retention rate } (\%) = \frac{G_1}{G} \times 100$$

where, G: tensile strength before exposure to light (N {kgf})

G_1: tensile strength after exposure to light (N {kgf}).

Assessment of the change in c l r shall b made by th use of the gray scale for assessing color change specified in JIS L 0804, as a rule,

The fading tester shall be of carbon arc lamp type or of xenon arc lamp type, and the test conditions shall be as sp cified in JIS L 0842 or JIS L 0843.

6.30 Weather Resistance

6.30.1 Method A Take the required number of the test specimens of the required size from the sample having been prepared in accordance with 3. Expose the specimens to the test light for the specified period of time by using testers specified in JIS B 7752 or JIS B 7753, take them out, dry naturally, and condition the moisture under the standard conditions. For the specimens thus conditioned, carry out the tests on the tensile strength (N), waterproofness and change in color, as required. For example, the tensile strength retention rate can be obtained by the formula below.

$$\text{Tensile strength retention rate } (\%) = \frac{G_1}{G} \times 100$$

where, G: tensile strenght before exposure (mN {gf})

G_1: tensile strenght after exposure (mN {gf}).

Assessment of the color change shall be made by the use of the gray scale for assessing color change specified in JIS L 0804, as a rule. The test conditions for the use of weather meter shall be as specified below, and other conditions, if any, shall be noted in the test report.

(1) Temperature of black panel: 63 ± 3°C

(2) Rotation speed of drum: 1 r.p.m.

(3) Spray pressure and number of nozzles: 78.5 to 127 kPa {0.8 to 1.3 kgf/cm^2}: 4 nozzles

(4) Spray time: 18-min spray for every 120-min exposure

(5) Spray water volume: 75.7 to 113.6 //h

(6) Water for raining spray: fresh water of pH 6.0 to 8.0 not staining the specimen.

(7) Humidity at time of exposure (without spray): 65 ± 5 % RH

(8) The light filter clouded or colored shall not be used.

(9) The light filter exceeding 2000 h of use shall not be used further.

Items to be noted in the test report are as follows.

(1) Name of tester used and shape of arc lamp used

(2) Number of lamps

(3) Averaged discharging voltage and current intensity

(4) Exposure time

6.30.2 Method B This test applies mainly to wool fabrics.

Take a test specimen of an appropriate size from the sample having been prepared in accordance with 3. Mount it on a wooden frame, and place the frame with its surface facing south with an inclination of 45° to the horizontal line on a roof or at any shadeless place. Continue to leave the specimen exposed to weather for 20 consecutive days. Assess the change in color of the specimen before and after the weathering test mentioned above.

When a standard sample is given, take a test specimen each from the sample and the standard sample, and subject them to the weathering test at the same time. Occasionally compare the change in color produced on the two specimens. If the change in color on the specimen of the sample is proved to be smaller than that produced on the specimen of the standard sample, the test may be discontinued in the course of the test duration of 20 days.

6.31 Mothproofness This test is applied to wool fabrics.

Take four test specimens, each measuring 3 to 4 cm in diameter, each from the mothproof-treated sample and the untreated control sample which are under as near the same condition as possible. Obtain the absolute dry mass (mg) of each specimen, and average both masses. Place each four mothproof-treated specimens and untreated control specimens separately in a tin container 4 to 5 cm in diameter or a Petri dish of the same shape, put 25 larvae ([66]) of harmful insect in each culture, and leave each culture in a darkened place in the test room under the standard conditions for 14 days. Then count the numbers (n and n') of live larvae in each culture, collect the excrement discharged from the larvae from the specimens with a feather broom, and weigh the excrement (w and w').

Next, obtain the absolute dry mass (mg) of each specimen, and average both masses.

Obtain the loss (mg) in mass of specimen by the formulas below.

$$G_1\ (\text{mg}) = w_1 - w_2$$

where, G_1: loss in mass of mothproof-treated specimen (mg)

w_1: average of absolute dry mass of four mothproof-treated specimens before test (mg),

w_2: average of absolute dry mass of four mothproof-treated specimens after test (mg).

$$G_2\ (\text{mg}) = w_1' - w_2'$$

where, G_2: loss in mass of untreated control specimen (mg)

w_1': average of absolute dry mass of four untreated specimens before test (mg),

w_2': average of absolute dry mass of four untreated specimens after test (mg).

Obtain the effectiveness (%) of mothproofing treatment for the mothproof fabric in question by the formula below.

$$\text{Effectiveness of mothproofing treatment } (\%) = \frac{G_2 - G_1}{G_2} \times 100$$

Note ([66]) The larvae of harmful insect to be used for the test shall be those which have been raised in advanc on wool matter, and the larvae which are as uniform in body length and in activity as possible shall be selected for the test.

Remark: Effectiveness (%) of a mothproofing agent to kill larvae can be estimated from the formula below.

$$\text{Effectiveness to kill larvae } (\%) = \frac{n' - n}{n'} \times 100$$

where, n: the number of larvae surviving in a Petri dish containing a mothproof-treated specimen

n': the number of larvae surviving in a Petri dish containing an untreated control specimen.

The degree of activity of larvae during the test can be estimated from the ratio of the excrement masses (u and u') discharged during the test.

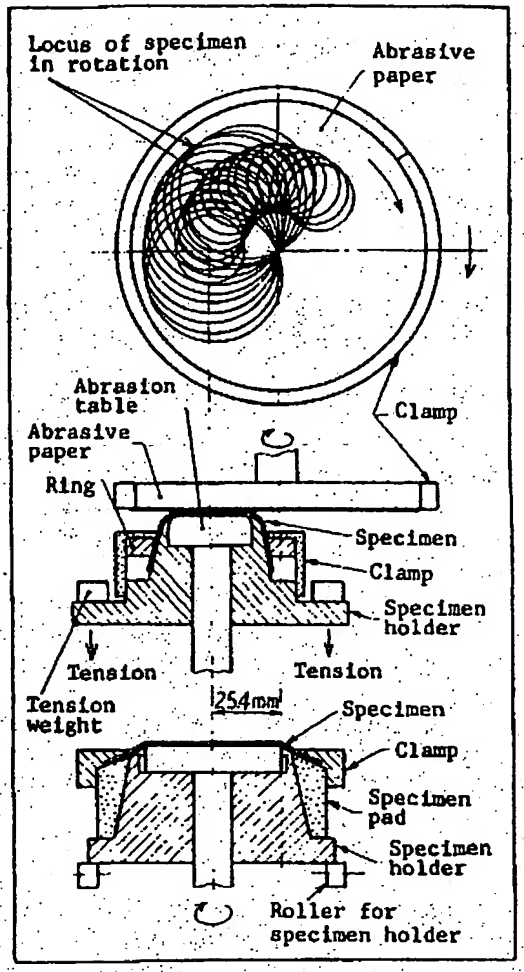
6.32 Color Change Due to Abrasion

6.32.1 Method A (Uniform Type Method) Take three circular test specimens, each measuring 10.0 cm in diameter, from the sample having been prepared in accordance with 3., and mount a specimen with its surface upwards on the specimen table (circular disk 5.0 cm in diameter) of a uniform type abrasion tester shown in Fig. 53. Then, use a spring steel blade as an abrasion element and abrade the specimen 100 times in various directions with a pressing load of 4.45 N {0.454 kgf}. Then, take out the specimen and assess ([68]) the difference in color between the abraded and the unabraded parts in contrast to the color differences manifested on the color chips on the gray scale ([67]) for assessing change in color. Express the degree of color change as average of three measurements. However, the number of rotations shall be about 64 r.p.m., and that of the specimen table shall be 62 r.p.m. When the spring steel blade is not used for the abrasion element, a note to that effect shall be appended to the test report.

Notes ([67]) The gray scale for assessing change in color shall be as specified in JIS L 0804.

([68]) Assessment shall follow the method specified in 10. of JIS L 0801.

Fig. 57. Construction of Uniform Type Abrasion Tester



6.32.2 Method B (Universal Type Method) Take three test specimens, each measuring 2.5 cm × 20 cm, from the sample having been prepared in accordance with 3. Use a universal type folding abrasion tester, and fold the specimen so that its surface is abrased by the bar. Abrade the specimen 100 times over a 2.5 cm stroke under the pressing load 2.23 N {0.227 kgf} and tension load of 4.45 N {0.454 kgf}. Next take out the specimen, and assess the difference in color between the abraded and the unabraded parts in contrast to the color differences manifested on the color chips on the gray scale ([67]) for assessing change in color to assign the ratings of the change in color.

6.32.3 Method C (Taber Type Method) Take three circular test specimens, each measuring 13 cm in diameter, and punch a hole approximately 6 mm in diameter in the center of each specim n. Use a taber type abrasion tester as given in Fig. 17, and mount the specimen on the rubber mat of the specimen holder with the surface of the sp cimen upwards. Next place the abrasion rollers ([69]) on the specimen, and abrade the specimen 100 times with a pressing load of 2.49 N {0.245 kgf}. Assess the difference in color between the abraded and the unabraded parts by comparison with the color difference manifested on the color chips on the gray scale for assessing change in col r to assign the ratings of the change in color.

Note ([69]) For th abrasion roller, SC-10 shall b used.

6.32.4 Method D (Martindale Method) This test applies mainly to wool fabrics.

Carry out the test by Method E specified in 6.17.5, and express the degree of color change by the number of rotations of abrasion required before the change in color reaches the rating No. 3 manifested on the gray scale for assessing change in color.

6.33 Size Content Take two test specimens, each weighing 2 g, from two different places ([4]) of a sample, and obtain each absolute dry mass (g). After desizing by any one of the methods described below, measure each absolute dry mass (g). Obtain the size content (%) by the formula below, and express it to one place of decimals as average of two measurements.

$$\text{Size content } (\%) = \frac{W - W'}{W'} \times 100$$

where, W: absolute dry mass before desizing (g)

W': absolute dry mass after desizing (g).

(1) Method A (Using Dilute Hydrochloric Acid) Put the specimens in a beaker, boil them in water for 10 min, further boil in 0.25 % hydrochloric acid solution ([70]) (liquor ratio 100 : 1) for 30 min, and then wash them thoroughly with warm water.

Note ([70]) Preparation of 0.25 % hydrochloric acid solution
Dilute 7 g of hydrochloric acid 1.18 to 1.19 in specific gravity (special grade specified in JIS K 8180) in water to make 1 l.

(2) Method B (Using Diastase) Put the specimens in a beaker, treat in hot water for 10 min, dip it in 2 to 3 % solution of diastase ([71]) (liquor ratio 50 : 1; temperature 50 to 60°C) for 1 hour, boil in water for 1 hour, and wash thoroughly with warm water several times.

Note ([71]) As specified in Japanese Pharmacopoeia as reagent.

(3) Method C (Using Sodium Carbonate) Put the specimens in a beaker, treat in hot water for 10 min, dip and stir in the solution of 5 g/l of sodium carbonate ([72]) and 2 g/l of nonionic surface active agent ([73]) (liquor ratio 100 : 1; temperature 80 to 90°C) for 1 h, and wash thoroughly with warm water.

Notes ([72]) Use sodium carbonate of special grade specified in JIS K 8625.

([73]) For noionic surface active agent, use polyoxyethylene-alkylallyl ether.

R marks 1. Methods A and B are applicable to the sizing agent made of starch, and the reaction shall be continued until the solution of dilute iodine proves that starch content does not exist.

2. Method C is applicable to the sizing agents made of acrylic acid type resin and of PVA.

3. The desizing method used shall be noted in the test report.

6.34 Qualitative Analysis of Resin and Resin Content The qualitative analysis of resin and the resin content shall be as described in JIS L 1041.

6.35 Oily and Fatty Matter

6.35.1 Method A (Carbon Tetrachloride Extraction Method) Take a test specimen of approximately 5 g in mass from a sample, obtain its absolute dry mass (g), and carry out extraction with 150 ml of carbon tetrachloride ([75]) in a Soxhlet extractor ([74]) for 2 h or longer (syphoning at least 10 times). Take the specimen out of the extractor, allow the solvent to vaporize in air, and obtain the absolute dry mass (g) of the specimen. Obtain the oily and fatty matter (%) by the formula below, and express it to two places of decimals as average of two measurements.

$$\text{Oily and fatty matter } (\%) = \frac{A-B}{A} \times 100$$

where, A : absolute dry mass before extraction (g)

B : absolute dry mass after extraction (g).

Notes ([74]) Use that specified in JIS R 3503.

([75]) Use that of special grade specified in JIS K 8459.

Remark: For cotton fabrics, this test is used.

6.35.2 Method B (Ether Extraction Method) Take about 5 g of a test specimen from the sample of which water content is known, accurately weigh it, and put it lightly into a Soxhlet extractor without use of cylindrical filter paper. Pour approximately 150 ml of ethyl-ether ([76]) in the attached flask, and place it on a water bath. Heat to the extent that the extraction keeps boiling slightly ([77]) for 1.5 h, and return the solution settled in the specimen to the flask. Concentrate the content of flask to 10 to 15 ml (if necessary, filter through 1 G 1 or 3 G 1 glass filter), and transfer into a weighing bottle of which absolute dry mass has been previously obtained. Wash the extraction flask with ether, and return the washings (in the case where glass filter is used, after filtering with that glass filter) to the weighing bottle. Volatilize the solvent on a water bath, and obtain the abs lut dry mass (g) of the residue. Express the xtract content ratio in percentage of ethyl ether extracted content to the absolute dry mass of th specimen. Make this test twice, and express the result to two palces of decimals as average of two measurements.

Notes (76) Use that of special grade specified in JIS K 8103.

(77) Heating shall be made to the xtent that the solvent returns through the syphonic tube at a rate of 1 tim per 10 min.

$$\text{Oily and fatty matter } (\%) = \frac{E}{W\left(1-\frac{R}{100}\right)} \times 100$$

where, W: mass of specimen (g)

E: ether extract (g)

R: official regain of specimen (%).

6.36 Solvent Extract

6.36.1 Method A (Alcohol Benzene Extraction Method) Take about 5 g of a test specimen from the sample of which water content is known, weigh it accurately, place it lightly in a Soxhlet extractor without use of cylindrical filter paper, put 100 to 120 ml of a mixed solution (78) (1 : 2 in liquor ratio) of alcohol and benzene into the attached flask, heat for 3 h to the extent (77) that the extraction keeps boiling slightly, and return the solution settled in the specimen to the flask. After concentrating the content in the flask to 5 ml or under (if necessary, filter through 1 G 1 or 3 G 1 glass filter), and transfer into a weighing bottle of whcih absolute dry mass has been previously obtained. Wash the extraction flask with a mixed solution of hot alcohol and benzene, and place the washings (if the glass filter mentioned above is used, after filtering through it) in a weighing bottle. Volatilize the solvent on a water bath, and obtain the absolute dry mass (g) of the residue. Express the extract content ratio in percentage of extract mass contained in the mixed solution of alcohol and benzene to the absolute dry mass (g) of the specimen. Make the test twice, and express the result to two places of decimals as average of two measurements.

Note (78) For the preparation of the mixed solution of alcohol and benzene, use ethyl-alcohol of 95 % by volume and benzene of a fraction at 79 to 82°C. When reusing a recovered mixed solution of alcohol and benzene, the solution shall be 1.7 ± 0.5 % in moisture.

$$\text{Solvent extract } (\%) = \frac{A}{W \times \left(1-\frac{R}{100}\right)} \times 100$$

where, W: mass of specimen (g)

A: alcohol and benzene extract (g)

R: official regain of specimen (%).

6.36.2 Method B (Carbon Tetrachloride Extraction Method) Take about 5 g of a specimen from the sample of which water content is known, accurately weigh it, put it in a suitable container, add 150 ml of dehydrated carbon tetrachloride, and immerse the specimen while stirring at 20 ± 2°C for 5 min. Pour the extracted liquid in a 500-ml Erlenmeyer flask, wash with 150 ml of carbon tetrachloride twice, concentrate the content of the flask

to 5 ml or under after adding it to the main liquid (if necessary, filter through 1 G 1 or 3 G 1 glass filter), and transfer into a weighing bottle of which absolute dry mass has been obtained. Wash the extraction flask with carbon tetrachloride, and place the washings (if the glass filter mentioned above is used, after filtering through it) in a weighing bottle. Volatilize the solvent, and obtain the absolute dry mass (g) of the residue. Express the extract content ratio in percentage of extract mass contained in carbon tetrachloride to the absolute dry mass of the specimen. Make the test twice, and express the result to two places of decimals as average of two measurements.

$$\text{Solvent extract (\%)} = \frac{A}{W\left(1-\frac{R}{100}\right)} \times 100$$

where, W: mass of specimen (g)

A: carbon tetrachloride extract (g)

R: official regain of specimen (%).

6.36.3 Method C (Methyl Alcohol Extraction Method) Take about 5 g of a specimen from the sample of which water content is known, accurately weigh it, place it lightly in a Soxhlet extractor without use of cylindrical filter paper, put 100 ml of methyl alcohol ([79]) into the attached flask, heat for 3 h to the extent ([77]) that the extraction may keep boiling slightly, and return the solution settled in the specimen to the flask. After concentrating the content contained in the flask to 5 ml or under (if necessary, filter through 1 G 1 or 3 G 1 glass filter), transfer it into a weighing bottle of which absolute dry mass (g) has been previously obtained. Wash the extraction flask with methyl alcohol, and place the washings (after filtering through it) in a weighing bottle. Volatilize the solvent, and obtain the absolute dry mass (g) of the residue. Express the extract content ratio in percentage of extract mass contained in methyl alcohol to the absolute dry mass of the specimen. Make the test twice, and express the result to two places of decimals as average of two measurements.

Note ([79]) Use ethyl alcohol of 95 % or over by volume and a fraction at 64 to 66°C.

$$\text{Solvent extract (\%)} = \frac{A}{W\left(1-\frac{R}{100}\right)} \times 100$$

where, W: mass of specimen (g)

A: methyl alcohol extract (%)

R: official regain of specimen (%).

6.37 Scouring Loss

6.37.1 Method A Take two test specimens, each measuring approximately 10 cm × approximately 10 cm, stitch each side with white cotton yarn to avoid unraveling, and weigh the absolute dry mass (mg). Treat the specimen in aqueous solution (50 : 1 in liquor ratio) of 50°C ± 2°C containing 0.25 % of bar soap ([80]) and 0.25 % of anhydrous sodium carbonate while stirring for 20 min, and wash thoroughly with water of 50°C ± 2°C. Obtain the absolute dry mass (mg) f the specimen, and obtain the scouring loss (%) by the formula below. Express it t one place of decimals as average of two

$$\text{Scouring loss rate } (\%) = \frac{W - W_1}{W} \times 100$$

where, W: absolute dry mass before scouring (mg)

W_1: absolute dry mass after scouring (mg).

Note ([80]) For the bar soap, that specified in JIS K 3302 without additives (Class 1) shall be used.

6.37.2 Method B Take about 5 g of a specimen from a sample, weigh its absolute dry mass (mg), put it in an Erlenmeyer flask together with approximately 0.5 % aqueous solution of nonionic surface active agent (100 times the specimen in volume), and treat it at 40 ± 2°C while stirring for approximately half an hour. Take the specimen on a funnel, wash thoroughly with warm water, dry, and weigh the absolute dry mass (mg). Obtain the scouring loss (%) by the formula below, and express it to one place of decimals as average of two measurements.

$$\text{Scouring loss rate } (\%) = \frac{W - W_1}{W} \times 100$$

where, W: absolute dry mass before scouring (mg)

W_1: absolute dry mass after scouring (mg).

6.38 Degumming Loss This test applies to silk fabrics.

Take three test specimens, each measuring 20 cm × 20 cm or larger, from three different places of a sample, and obtain the mass of each specimen under the standard conditions. Boil the specimens in aqueous solution (30 : 1 in liquor ratio) of 0.5 % of soap ([79]) and 0.2 % of sodium silicate ([81]) for 1 h. Wash with warm water and then with water several times. After drying, obtain the mass under the standard conditions. For fabrics which are usually subjected to double degumming, such as fabrics medium or heavier in Metsuke and special fabrics ([82]), repeat the above procedure once again, and obtain the mass under the standard conditions.

Calculate the degumming loss (%) by the formula below, and express it to one place of decimals as average of three measurements.

$$\text{Degumming loss } (\%) = \frac{W - W'}{W} \times 100$$

where, W: mass before extraction (g)

W': mass after extraction (g).

Notes ([81]) Use Nos. 1 to 3 sodium silicate specified in JIS K 1408.

([82]) For example, the fabrics close in weave such as poplin and the fabrics made from hard twist yarns.

6.39 Free Formaldehyde Content The free formaldehyde content shall be as described in 5.3 of JIS L 1041.

6.40 pH Valu of Extract Liquid This test applies to wool fabrics.

Take a test specimen weighing 5.0 ± 0.1 g in mass from a sample, and cut it into several small pieces measuring approximately 1 cm × approximately 1 cm. Separately put 50 ml of distilled water into a 200-ml flask with a glass stopper, boil gently for 2 min, and keep the flask away from the heat source. Then put the small pieces prepared as described above into the flask, close it with the stopper, and leave it still for half an hour. Occasionally during that period, loosen the stopper and shake the flask. After the completion of the above-mentioned procedure, adjust the temperature of the extracted liquid to 25 ± 2°C. Employing a pH meter with glass electrodes specified in JIS Z 8805, obtain the pH value of the extracted liquid thus adjusted, and express the value to one place of decimals as average of the measurements made for two pieces.

6.41 Barium Activity Number This test applies to cotton fabrics.

Put a cleaned test specimen ([83]) and a standard specimen ([84]) in a thermostatic drier, take them out of the drier after drying, and leave them still in a room for 2 h or longer to condition the moisture. Cut the test specimen into the length of approximately 2 cm and the standard specimen into a size of approximately 1 cm^2, and take a test piece weighing 2.18 g from the test specimen and a standard piece weighing 2.12 g from the standard specimen.

Prepare three 100-ml Erlenmeyer flasks, and put the test piece into one of them and the standard piece into another. (The remaining one is to be furnished for the blank test.)

Pour quickly 30 ml of N/4 barium hydroxide solution ([85]) into each of the flasks, immediately plug tightly, shake the flasks gently for a while, and leave them still at a temperature of 20 to 25°C for 2 h or longer. Take accurately 10 ml of the solution out of each flask, and titrate each solution with N/10 hydrochloric acid ([87]) by adopting phenolphthalein ([86]) as the indicator. Obtain ([88]) the barium activity number by the formula below, and express it to a digit of integer as average of two measurements.

$$\text{Barium activity number} \quad \frac{B-S}{B-U} \times 100$$

where, B: amount of N/10 hydrochloric acid consumed for blank test (ml)

S: amount of N/10 hydrochloric acid consumed for test made for test piece immersion liquid (ml)

U: amount of N/10 hydrochloric acid consumed for test made for standard piece immersion liquid (ml).

Notes (83) For the purpose of obtaining as pure cotton fib r as p ssible by removing nonfibrous matters without giving chemical change to them, put the test specimen together with the standard sp cimen in a solution of 0.5 % anhydrous sodium carbonate (sp cial grade specified in JIS K 8625) (100 : 1 in liquor ratio) at a temperature of 90 to 95°C, treat them while occasionally stirring for 15 min, and rinse them with hot water of 60 to 70°C repeatedly until alkali disappears. If starch or resin adheres to the test specimen, treat it together with standard specimen in a solution of 0.25 % hydrochloric acid (special grade specified in JIS K 8180) (50 : 1 in liquor ratio) at temperature of 90°C for half an hour, and rinse them thoroughly with hot water of 90°C several times.

(84) As the standard specimen, use undyed cloth for staining No. 3 (cotton cloth) specified in JIS L 0803. For the purpose of producing a standard specimen in the same condition as that of the test specimen, pretreat the former in the same way as that for the latter, as a rule.

(85) Preparation of N/4 barium hydroxide solution. Take 40 g of barium hydroxide (special grade specified in JIS K 8577), dissolve in 1 l of water, and leave it still to use its supernatant liquid.

(86) Dissolve 0.5 g of phenolphthalein (special grade specified in JIS K 8799) in 100 ml of ethyl alcohol (special grade specified in JIS K 8101).

(87) Preparation of N/10 hydrochloric acid. Dilute 11 ml of hydrochloric acid (special grade specified in JIS K 8180) (1.18 to 1.19 in specific gravity) in 1 l of water, and standardize it in a usual way.

(88) If two obtained values differ by 4 or more in the barium activity number, make two additional tets, and obtain an average of four measurements.

Remark: To fabrics to which any durable finishing agent adheres, this test is not applicable.

6.42 Permissible Ironing Temperature This test applies to wool fabrics.

Take a test specimen of a suitable size from a sample, and place it on an iron pad. Use a heated electric iron (equipped with temperature controlling device) weighing 2.27 kg, move it back and forth 10 times at a stroke of 10 cm for approximately 20 s, and examine the surface of the specimen. Apply a surface thermometer to the bottom of the heated iron to measure the temperature of the iron. In order to determine the permissible ironing temperature, make 11 tests at an interval of 10°C in the range from 80°C to 180°C, and regard the temperature preceding that at which the change in surface condition is first noticed as the permissible ironing temperature for the fabric. The change in surface condition means the phenomenon which falls under any one of the following:

(1) Fibers melt and stick to the bottom of the iron hindering the smooth movement of the iron.

(2) The surface is hardened, fibers fluff, or pillings form.

(3) The surface is scorched or changed.

(4) The area of the specimen shrinks suddenly.

6.43 Glossiness The glossiness shall be expressed by the luster measured from various directions.

For the measurement, there are such instruments as Görts glossmeter. Görts glossmeter has a construction capable of comparing the intensity of light which is reflected regularly on the surface of an object with that of light which is reflected irregularly at right angles to the former. It can calculate the glossiness from the following formula by measuring the rotation angle of the absorption plate incorporated in itself.

$$\log (G+1) = 0.001962\,\alpha$$

where, G: glossiness

α: reading of rotation angle of absorption plate in glossmeter.

6.44 Comparison of Colors This method applies to wool fabrics.

Compare a test specimen with a standard specimen visually under the same condition by exposing to daylight passing through a northern window. If daylight passing through a northern window is not available, comparison may be made under the standard illuminant C in the same way. If a color allowance sample is provided in addition to a standard sample, examine whether the color of the test specimen is in between the standard sample and the color allowance given.

Remark: For the standard illuminant C, refer to JIS Z 8701.

6.45 Foreign Matter and Nep Take three test specimens, each measuring 20 cm × 20 cm, from the sample having been prepared in accordance with 3. Count the number of foreign matters and neps existing on both faces of an arbitrary area of 10 cm × 10 cm by means of a suitable device. Express them to a digit of integer as average of three measurements.

6.46 Shrinkage Percentage As described in JIS L 1042.

6.47 Shrinkage Percentage of Ironing As described in JIS L 1057.

6.48 Pilling As described in JIS L 1076.

6.49 Snag As described in JIS L 1058.

6.50 Pil Ret ntion As described in JIS L 1075.

6.51 Flame Retardance As described in JIS L 1091.

6.52 Electrification by Friction As described in JIS L 1094.

6.53 Water Resistance As described in JIS L 1092.

6.54 Water Vapor Permeability As described in JIS L 1099.

6.55 Color Fastness

6.55.1 Light Color Fastness As described in JIS L 0841, JIS L 0842 and JIS L 0843.

6.55.2 Washing and Laundering Color Fastness As described in JIS L 0844.

6.55.3 Hot Water Color Fastness As described in JIS L 0845.

6.55.4 Water Color Fastness As described in JIS L 0846.

6.55.5 Sea Water Color Fastness As described in JIS L 0847.

6.55.6 Perspiration Color Fastness As described in JIS L 0848.

6.55.7 Rubbing Color Fastness As described in JIS L 0849.

6.55.8 Hot Pressing Color Fastness As described in JIS L 0850.

6.55.9 Acid Spotting Color Fastness As described in JSI L 0851.

6.55.10 Alkali Spotting Color Fastness As described in JIS L 0852.

6.55.11 Water Spotting Color Fastness As described in JIS L 0853.

6.55.12 Sublimation in Storage Color Fastness As described in JIS L 0854.

6.55.13 Nitrogen Oxide Color Fastness As described in JIS L 0855.

6.55.14 Bleaching with Hypochlorite Color Fastness As described in JIS L 0856.

6.55.15 Dry Cleaning Color Fastness As described in JIS L 0860.

6.55.16 Organic Solvents Color Fastness As described in JIS L 0861.

6.55.17 Rubbing with Organic Solvents Color Fastness As described in JIS L 0862.

6.55.18 Dry Heating Color Fastness As described in JIS L 0879.

6.55.19 Chlorinated Water Color Fastness As described in JIS L 0884.

6.55.20 Light of Fluorescent Whitening Agents and Fluorescent Whitened Textiles Color Fastn ss As described in JIS L 0887.

6.55.21 Light and Perspiration Color Fastness As described in JIS L 0888.

6.55.22 Bleaching with Sodium Percarbonate Color Fastness As described in JIS L 0889.

6.56 Migration of Dyestuffs and Finishing Agents As described in JIS L 1063.

6.57 Dyestuff Classes A described in JIS L 1065.

6.58 Fluorescent Brightening Agents Classes As described in JIS L 1064.

6.59 Mixture Ratio As described in JIS L 1030.

6.60 Seam Strength As described in JIS L 1093.

6.61 Bagging As described in JIS L 1061.

Informative Reference:

1. Calculation Formulas

1.1 Percentage of Deviation

$$\text{Percentage of deviation } (\pm\%) = \frac{a-b}{b} \times 100$$

where, a: measured value

b: indicated value.

1.2 Standard Deviation

$$\text{Standard deviation} = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$$

where, x: individual measured value

$\bar{x}$: total average

n: total number of measurements.

1.3 Coefficient of Variation

$$\text{Coefficient of variation } (\%) = \frac{\sqrt{\Sigma(x-\bar{x})^2/n-1}}{\bar{x}} \times 100$$

where, x: individual measured value

$\bar{x}$: total average

n: total number of measurements.

1.4 Ratio of Wet Strength to Dry Strength

$$\text{Ratio of wet strength to dry strength } (\%) = \frac{S_w}{S_D} \times 100$$

where, S_D: tensile strength under standard condition (N {gf})

2. Number of Tests

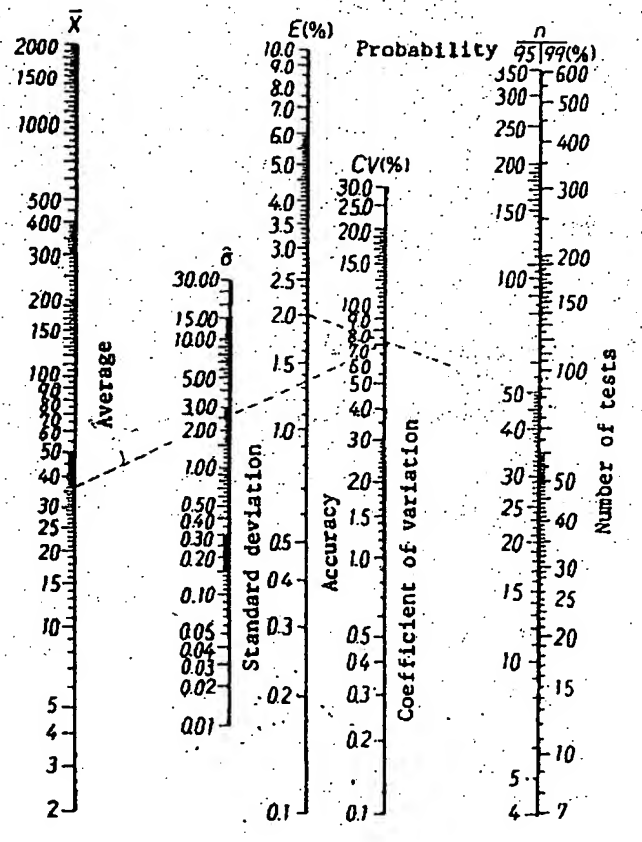
When th number of tests is to be predetermined between the parties conc rned, it is recommended that the determination follow the practice described below. Obtain it by the aid of either Informative Reference Fig. 1 Nomogram 1 or either Informative Reference Fig. 2 Nomogram 2 according to the coefficient of variation (i.e. ratio in percentage of estimated standard deviation ([1]) to average), the required accuracy ([2]) and the probability.

Nomogram shall be used as follows: read the intersection of the straight line which connects the coefficient of variation and the accuracy and the scale of number of tests by the aid of scale of probability, and discard the figures below decimals.

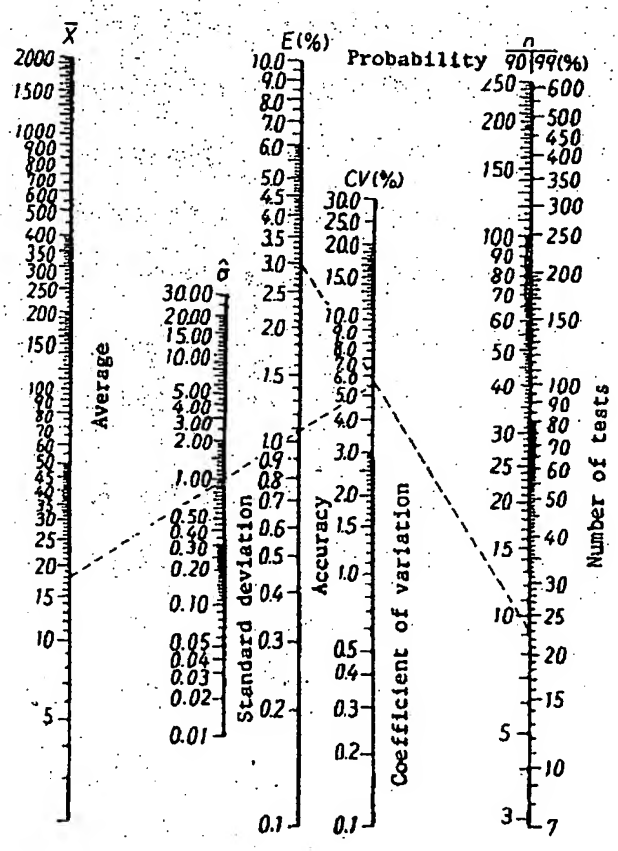
Notes ([1]) For obtaining an estimated standard deviation, refer to 5.1 in Explanation attached to JIS Z 9042 to Z 9049.

([2]) Accuracy is defined as the percentage of the value obtained by dividing the difference in average in question by the average.

Informative Refrence Fig. 1.
Nomogram 1



Informative Reference Fig. 2
Nomogram 2



Applicable Standards:

JIS B 7752-Light-and-Water-Exposure Apparatus (Enclosed Carbon Arc Type)

JIS B 7753-Light-and-Water-Exposure Apparatus (Open-Flame Sunshine Carbon Arc Type)

JIS C 7601-Fluorescent Lamps for General Lighting Service

JIS H 4170-High Purity Aluminium Foils

JIS K 0050-General Rules for Chemical Analysis

JIS K 1408-Sodium Silicate

JIS K 3302-Laundry Bar Soap

JIS K 3371-Synthetic Detergents for Home Laundering

JIS K 8101-Ethanol (99.5) [Ethyl Alcohol (99.5)]

JIS K 8103-Diethyl Ether

JIS K 8180-Hydrochloric Acid

JIS K 8459-Carbon Tetrachloride

JIS K 8577-Barium Hydroxide

JIS K 8625-Sodium Carbonate, Anhydrous

JIS K 8799-Phenolphthalein

JIS L 0801-General Principles of Testing Methods for Color Fastness

JIS L 0803-Standard Adjacent Fabrics for Staining of Color Fastness Test

JIS L 0804-Gray Scale for Assessing Change in Color

JIS L 0805-Gray Scale for Assessing Staining

JIS L 0841-Testing Methods for Color Fastness to Daylight

JIS L 0842-Testing Methods for Color Fastness to Carbon Arc Lamp Light

JIS L 0843-Testing Methods for Color Fastness to Xenon Arc Lamp Light

JIS L 0844-Testing Methods for Color Fastness to Washing and Laundering

JIS L 0845-Testing Method for Color Fastness to Hot Water

JIS L 0846-T sting Method for Color Fastness to Water

JIS L 0847-Testing Method for Color Fastness to Sea Water

JIS L 0848-Testing Method for Color Fastness to Perspiration

JIS L 0849-Testing Method for Color Fastness to Rubbing

JIS L 0850-Testing Method for Color Fastness to Hot Pressing

JIS L 0851-Testing Method for Color Fastness to Acid Spotting

JIS L 0852-Testing Method for Color Fastness to Alkali Spotting

JIS L 0853-Testing Method for Color Fastness to Water Spotting

JIS L 0854-Testing Method for Color Fastness to Sublimation in Storage

JIS L 0855-Testing Method for Color Fastness to Nitrogen Oxides

JIS L 0856-Testing Methods for Color Fastness to Bleaching with Hypochlorite

JIS L 0860-Testing Method for Color Fastness to Dry Cleaning

JIS L 0861-Testing Method for Color Fastness to Organic Solvents

JIS L 0862-Testing Method for Color Fastness to Rubbing with Organic Solvents

JIS L 0879-Testing Method for Color Fastness to Dry Heating

JIS L 0884-Testing Methods for Color Fastness to Chlorinated Water

JIS L 0887-Testing Method for Color Fastness to Light of Fluorescent Whitening Agents and Fluorescent Whitened

JIS L 0888-Testing Method for Color Fastness to Light and Perspiration

JIS L 0889-Testing Methods for Color Fastness to Bleaching with Sodium Percarbonate

JIS L 1013-Testing Methods for Man-Made Filament Yarns

JIS L 1030-Testing Methods for Quantitative Analysis of Fiber Mixtures

JIS L 1041-Testing Methods for Resin Finished Textiles

JIS L 1042-Testing Methods for Shrinkage Percentage of Woven Fabrics

JIS L 1057-Testing Methods for Shrinkage Percentage by Ironing of Woven and Knitted Fabrics

JIS L 1058-Testing Methods for Snag of Wov n Fabrics and Knitted Fabrics

JIS L 1059-Testing Methods for Crease Recovery of Woven Fabrics

JIS L 1060-Testing Methods for Pleating of Woven and Knitted Fabrics

JIS L 1061-Testing Methods for Bagging of Woven and Knitted Fabrics

JIS L 1063-Testing Methods for Migration of Dyestuffs and Finishing Agents on Woven Fabrics and Knitted Fabrics

JIS L 1064-Identification of Fluorescent Brightening Agents Classes on Textiles

JIS L 1065-Identification of Dyestuff Classes on Dyed Textiles

JIS L 1075-Testing Methods for Pile Retention of Woven and Knitted Fabrics

JIS L 1076-Testing Method for Pilling of Woven Fabrics and Knitted Fabrics

JIS L 1091-Testing Methods for Flammability of Clothes

JIS L 1092-Testing Methods for Water Resistance of Clothes

JIS L 1093-Testing Methods for Seam Strength of Clothes

JIS L 1094-Testing Methods for Electrostatic Propensity of Woven and Knitted Fabrics

JIS L 1095-Testing Methods for Spun Yarn

JIS L 1099-Testing Methods for Water Vapour Permeability of Clothes

JIS L 2101-Cotton Sewing Thread

JIS L 2511-Polyester Sewing Threads

JIS P 3801-Filter Paper (for Chemical Analysis)

JIS R 3503-Glass Apparatus for Chemical Analysis

JIS R 6253-Waterproof Abrasive Papers

JIS Z 8701-Specification of Colors According to the CIE 1931 Standard Colorimetric System and the CIE 1964 Supplementary Standard Colorimetric System

JIS Z 8703-Standard Atmospheric Conditions for Testing

JIS Z 8805-Glass Electrodes for Measurement of pH

JIS Z 8806-Methods of Humidity Measurement

Corresponding International Standards:

ISO 139-1973	Textiles-Standard atmospheres for conditioning and testing
ISO 2313-1972	Textiles-Determination of the recovery from creasing of a horizontally folded specimen of fabric by measuring the angle of recovery
ISO 2959-1973	Textiles-Woven fabric descriptions
ISO 2960-1974	Textiles-Determination of bursting strength and bursting distension-Diaphragm method
ISO 3071-1980	Textiles-Determination of pH of the aqueous extract
ISO 3572-1976	Textiles-Weaves-Definitions of general terms and basic weaves
ISO 3801-1977	Textiles-Woven fabrics-Determination of mass per unit length and mass per unit area
ISO 3932-1976	Textiles-Woven fabrics-Measurement of width of pieces
ISO 3933-1976	Textiles-Woven fabrics-Measurement of length of pieces
ISO 5081-1977	Textiles-Woven fabrics-Determination of breaking strength and elongation (Strip method)
ISO 5082-1982	Textiles-Woven fabrics-Determination of breaking strength -Grab method
ISO 5084-1977	Textiles-Determination of thickness of woven and knitted fabrics (other than textile floor coverings)
ISO 7211/1-1984	Textiles-Woven fabrics-Construction-Methods of analysis-Part 1 : Methods for the presentation of a weave diagram and plans for drafting, denting and lifting
ISO 7211/2-1984	Textiles-Woven fabrics-Construction-Methods of analysis-Part 2 : Determination of number of threads per unit length
ISO 7211/3-1984	Textiles-Woven fabrics-Construction-Methods of analysis-Pasrt 3 : Determination of crimp of yarn in fabric
ISO 7211/4-1984	Textiles-Woven fabrics-Construction-Methods of analysis-Part 4 : Determination of twist in yarn removed from fabric
ISO 7211/5-1984	Textiles-Woven fabrics-Construction-Methods of analysis-Part 5 : Determination of linear density of yarn removed from fabric

ISO 7211/6-1984 Textiles-Woven fabrics-Construction-Methods of analysis-Part 6 : Determination of the mass of warp and weft per unit area of fabric

Reference Standards:

AATCC Test Method 124-1984 Appearance of Durable Press Fabrics after Repeated Home Launderings

JIS L 0101-Tex System to Designate Linear Density of Fibers, Yarn Intermediates, Yarns and Other Textile Materials

JIS L 0104-Designation of Yarns by Tex System

JIS Z 8203-SI Units and the Use of their Multiples and of Certain Other Units

JIS Z 9042-Significance Test of Difference between the Population Mean and the Standard (Standard Deviation Known, One-Sided)

JIS Z 9043-Significance Test of Difference between the Population Mean and the Standard (Standard Deviation Known, Two-Sided)

JIS Z 9044-Significance Test of Difference between the Population Mean and the Standard (Standard Deviation Unknown, One-Sided)

JIS Z 9045-Significance Test of Difference between the Population Mean and the Standard (Standard Deviation Unknown, Two-sided)

JIS Z 9046-Significance Test of Difference between the Two Population Means (Standard Deviations Known One-Sided)

JIS Z 9047-Significance Test of Difference between the Two Population Means (Standard Deviations Known, Two-Sided)

JIS Z 9048-Significance Test of Difference between the Two Population Means (Standard Deviations Unknown, One-Sided)

JIS Z 9049-Significance Test of Difference between the Two Population Means (Standard Deviations Unknown, Two-Sided)